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## DISEASES DUE TO PROTOZOAN PARASITES.

### (a) LEISHMANIASIS.

LAVERAN (A.) & HAVET (J.). **Contribution à l'étude de la leishmaniose viscérale naturelle du chien.** [Natural Leishmaniasis of the Dog.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 386–392. With 1 fig.

A young bitch inoculated intravenously with the bone marrow of a dog infected with naturally contracted canine leishmaniasis (first passage from a dog received from Tunis) died 117 days after inoculation. Death occurred as the result of abdominal haemorrhage due to rupture of the spleen capsule; post-mortem examination revealed very noteworthy lesions in the spleen and liver.

The spleen weighed 345 grammes, that is, about 17 times the normal weight of the spleen of a dog weighing 10 kilogrammes. A rupture of the capsule was found on the external surface of the organ; the parenchyma was much softened and contained a haemorrhagic centre and two infarcts. The liver was larger and lighter in colour than normal; the bone marrow was red and diffluent.

Microscopic examination showed very considerable numbers of Leishmania in the bone marrow, in the spleen, and in the liver.

In the bone marrow the Leishmania were found free-lying or enclosed within the cellular elements, principally the bone marrow cells, and sometimes within the nuclei of these cells.

In the spleen the leucocytes principally contained the parasites; the connective tissue cells and the endothelial cells of the capillaries were also found invaded. Sometimes Leishmania were found in the interior of the nuclei of the cells.

In the liver the hepatic cells were observed to be the predilection seat of the parasites. Leishmania were also found in connective tissue cells, in plasma cells, and in the capillary blood vessels but to a far less extent. The authors' observations do not agree upon this point with those of CHRISTOPHERS and of STATHAM; according to these observers the predilection seat of Leishmania in human kala azar is the endothelial cells of the capillary blood vessels. Marked alterations were found by the authors in the structure of the liver.

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LAVERAN (A.). **Boutons d'Orient expérimentaux chez un *Cercopithecus mona* et chez un *Cercocebus fuliginosus*.** [The Production of Experimental Oriental Boils in a *C.m.* and a *C.f.*]—*Bull. Soc. Path. Exot.* 1917. April. Vol. 10. No. 4. pp. 291–293.

In this short article Laveran describes observations dealing with the experimental transmission of *Leishmania tropica* from an infected mouse to two more species of monkeys; the author had already effected transmission to four species. The two monkeys now experimented on were inoculated on the outer surface of the right thigh and both developed very marked oriental boils, thus producing as satisfactory a result as in the case of the monkeys previously tested. It was interesting in the case of the *Cercocebus fuliginosus* or "mangabey," which appears to be immune towards *Trypanosoma gambiense*, to find out whether the inoculation of oriental boil would succeed as well as in the case of the species already known to be sensitive to this virus and to *T. gambiense*.

LAVERAN (A.). **Boutons d'Orient chez un Mandrill.** [Oriental Boils in a Mandrill.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 455–456.

In this note Laveran announces the infection of another species of monkey with *L. tropica* from infected mice. The mandrill (*Mormon maimon*) was inoculated in the usual way by puncturing the skin three times on the outer surface of the right thigh. Six days afterwards small hard swellings appeared containing numerous Leishmania. The boils increased in size and in three weeks were about the size of large peas and began to ulcerate. Later, the boils increased further in size, became extensively ulcerated, and suppurated; the parasites became fewer and presented a degenerated appearance. After a month the swellings diminished in size, the parasites disappeared, until in six weeks time the lesions had become cicatrised, leaving only small intradermal thickenings.

(b) SPIROCHAETOSIS.

LEGER (André) & LE GALLEN (R.). **Spirochétose des poules au Sénégal. Son évolution clinique.** [Fowl Spirochaetosis in Senegal. Its Clinical Course.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 435–438.

The above disease is a very common and serious affection among fowls in Senegal causing great losses during the dry season and becoming less intense or even disappearing at the commencement of the rainy season. The causal organism is *Spirochaeta neveuxi* Brumpt, 1909, an organism almost identical in appearance with the ordinary *Sp. gallinarum* but differing from it inasmuch as immunity set up against the one organism does not protect against infection by the other. The pathogenicity of the spirochaete studied by BRUMPT differs a little from that of the authors' organism in that recovery is not the rule.

Twenty-five susceptible young fowls, free from Argas, placed in an infected run, commenced after a period of from five to seven days to show the usual symptoms, viz., more or less intense diarrhoea, depression, inappetence, fever, feathers erect and dirty-looking, and dull and

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flabby comb. Microscopic examination of the blood revealed numerous spirochaetes, but the mortality at this stage was inconsiderable; two pullets only succumbed.

The course of the disease thenceforward may lead directly towards recovery; thus four fowls after presenting spirochaetes in their blood for from seven to eight days afterwards showed no abnormality and became definitely cured. Generally, however, after the onset of the crisis the condition of the animal changes, becoming slightly better. The appetite improves a little and the diarrhoea is markedly lessened. There only remains a condition of intense anaemia. This stage lasts about a fortnight, then a number of secondary symptoms set in, and at the same time the red blood corpuscles show a number of the so-called "after-phase" bodies of BALFOUR.

In this secondary stage one may observe symptoms of two different degrees of severity. In the first place, the wasting may become progressive in spite of the appetite having recovered, the comb becomes covered with crusts which gradually extend over the whole head especially along the eyelids, and underneath these crusts, which are easily separated, are seen smooth ulcers exuding a serous liquid. Symptoms of partial paralysis also set in but these are usually transitory. Four out of 19 pullets which had arrived at this stage recovered.

In the second place, the above symptoms may continue to progress; the ulcerations affecting the head spread down the neck, and similar lesions develop on the breast and legs. A stinking viscous liquid flows from the beak, the eyelids become closed and underneath them a white caseous mass about the size of a hazel nut becomes formed and produces marked changes in the eye itself on account of pressure. In spite of the absence of fever the animal becomes extremely emaciated, but the appetite remains only slightly diminished. This second stage does not generally last more than from four to five months; 12 out of 15 pullets then died and 3 only survived; in spite of their serious condition the latter became completely cured.

BLANCHARD (R.). **Spirilles et Spirochètes.** [Spirilla and Spirochaetes.] —*Bull. Acad. Méd.* 1916. Nov. 7. Extracted in *Rec. Méd. Vét.* 1917. Apr. 15–May 15. Vol. 93. Nos. 7 & 8. pp. 225–226.

"The relationship existing between spirilla and spirochaetes is still the object of discussion. According to the author spirilla are large bacteria belonging consequently to the vegetable kingdom and live as saprophytes in water rich in organic matter. None of them is pathogenic or parasitic and in the actual state of knowledge there is no known spirillosis in man or in any animal.

"Spirochaetes are found in the bodies of man and of different animals; a large number are pathogenic and cause severe diseases, which are *spirochaetoses* (for example, recurrent fever, tick fever, ictero-haemorragica, syphilis). In spite of their resemblance to spirilla spirochaetes have the greatest affinities with the protozoa; they would thus belong to the animal kingdom. With the exception of syphilis spirochaetoses are inoculated diseases transmitted from one individual to another by the bite of an arthropod (acarian or insect).

"The conclusions of the distinguished professor are as follows:—

"(1) Spirilla should not be confused with spirochaetes as is done by a large number of authors.

"(2) The spirilla are neither pathogenic nor parasitic; a large number of spirochaetes are parasitic and pathogenic.

"(3) All the diseased conditions attributed to spirilla are due to spirochaetes. One knows of multiple examples of spirochaetoses; one does not know at present of any spirillosis, even on taking into consideration the whole animal series.

"(4) To speak in human or comparative pathology of spirilla and of spirillosis in cases of spirochaetes and spirochaetosis is not only to commit an error in language but also to ignore zoological and botanical nomenclature, without the observance of which scientific language could not attain rigorous precision; it amounts to breeding or maintaining inaccurate scientific notions which are very prejudicial to the progress and diffusion of science."

LEGER (André). **Spirochète de la musaraigne** (*Crocidura Stampflii* **Jentink**). [A Spirochaete of the Shrewmouse.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 280–281.

Leger adds still another spirochaete to the list of those already found in the blood of mammals. The insectivorous host was caught in the sewers of Dakar, French Senegal. In the blood the spirochaetes were fairly numerous (1 per 15 fields of the microscope, $\frac{1}{15}$ inch Stiassnie lens) and presented fairly active movements. The organism was on an average from 14 to 16$\mu$ in length by about ·25$\mu$ in breadth and possessed four or five spirals; after staining it was seen as a straight or slightly curved spiral filament with whip-like extremities. The spirals were generally irregular in size measuring 2$\mu$ in width by 1 to 1·5$\mu$ in depth. Blood examination also revealed a large number of *Anaplasma marginale* and a very few parasites of the genus Grahamella. The pathogenicity of the spirochaete will be described later by the author. The name *Spirochaeta crocidurae* is given to the organism.

CARPANO (Matteo). **Su di uno spirochete osservato nel topo bianco** (*Mus rattus* **var.** *alba*) **e qualche considerazione su alcuni spirocheti saprofiti.** [A Spirochaete Observed in the White Rat and some Considerations on Certain Saprophytic Spirochaetes.]—*Nuovo Ercolani.* 1917. May 15 & 31. Vol. 22. Nos. 9 & 10. pp. 141–146 & 163–168. With 2 text figs.

A white rat which had been inoculated intraperitoneally with a broth culture of a streptococcus died after two days with lesions of intense peritonitis. In the peritoneal exudate, besides abundant streptococci, there was a considerable number of spirochaetes, some occurring singly, some in process of division, and some in clumps. In fresh preparations a number appeared to execute rather active movements while others were almost non-motile. The movements were of three types, propeller-like, serpentine, and a motion of contraction and expansion like the uncoiling of a spring.

The organisms were stained with difficulty; Ziehl's carbolfuchsin diluted and slightly heated, and Giemsa 1 in 10 applied for about 12 hours, gave the best results. When stained, single spirochaetes measured from 5 to 12$\mu$ by ·25$\mu$ in thickness and usually possessed from two to three large spirals. S-shaped and other forms were seen. The ends were often sharp but in some cases one end was apparently blunted. The interior often appeared to contain elongated granules with a nuclear appearance. Traces of a lateral membrane could be seen in some. There were no visible lateral or terminal cilia. Reproduction appeared to take place by transverse fission but a few elements

appeared coupled closely parallel to each other. Spindle-shaped bacillary forms were also observed in the peritoneal exudate.

In the heart blood a few very scanty spirochaetes similar to those found in the peritoneal exudate were discoverable, but no spindle-shaped elements could be seen.

In the gastric and intestinal contents of this animal numerous spirochaetes were found of two distinct types, (1) stumpy elements from 6 to 12$\mu$ in length by 1$\mu$ in breadth with three or four shallow spirals and rounded ends, and (2) more numerous elements of the same nature as those seen in the peritoneal exudate and in the blood. In healthy rats belonging to the same lot as the above rat numerous microscopical examinations failed to reveal spirochaetes in the circulating blood; they were, however, easily distinguishable in the gastro-intestinal contents, especially in the caecum. Inoculation of a loopful of the peritoneal exudate from the dead rat into a healthy white rat produced no effect.

The author proceeds to discuss at length the significance of this secondary invasion with spirochaetes supervening on a streptococcic infection. A list of spirochaetes discovered by various authors in animals in health and disease is given. The author believes that many of these spirochaetes live normally as saprophytes in the digestive, excretory, or respiratory tract of animals, but probably play a considerable rôle as secondary invaders when the resistance of the membranes has been lowered by some disease-producing agent. The case of spirochaetes in the lesions of pigs infected with swine fever is quoted as one example.

### (c) Piroplasmoses.

Yakimoff (W. L.), Schokhor (N. J.), Koselkine (P. M.) & Paroïsky (P. S.). **Maladies animales du Turkestan russe à parasites endoglobulaires.** [Animal Diseases caused by Intracorpuscular Parasites in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 302–311.

The following are results published by the Commission appointed for investigating human and animal tropical diseases in Russian Turkestan, sent by the George Speyer Institute, Frankfort-on-Main, the Imperial Institute of Experimental Medicine of Petrograd, and the Veterinary Department of the Ministry of the Interior, Russia.

*Piroplasmoses.*—Bovine piroplasmosis had been recorded in Turkestan by Kovalevsky and Stolnikoff, but these authors probably confused two distinct diseases—piroplasmosis and theileriasis—as well as some bacterial diseases, as blood examinations were not always made; in one outbreak a mortality of 61·5 per cent. was recorded. Bovine piroplasmosis was identified by Yakimoff and his co-workers in two localities, the symptoms being similar to those of redwater in other countries. The *P. bigeminum* presented the usual morphological characters: pear-shaped forms 1·42 to 2·13$\mu$ × 1 to 1·42$\mu$, round forms 1·4 to 2·13$\mu$. Trypan blue gave very good results in the treatment of affected animals. Twenty-five cc. of a 1 per cent. solution in normal saline were injected; a total dose of from two to three grammes was sufficient even in the acute form. The parasites disappeared from the blood within 12 hours and the temperature came down. The cure was complete.

Equine piroplasmosis has existed for a long time in several localities in Turkestan. KOVALEVSKY (1909) discovered small round-shaped blood parasites characteristic of piroplasmosis on post-mortem examination of a horse. The authors themselves identified two species of parasites, viz., *Piroplasma caballi* and *Nuttallia equi*. The symptoms of the disease caused by *P. caballi* are fever, up to 41·4° C., pulse up to 100, thready in some cases, respiration up to 40 and of the abdominal type, loss of appetite, and depression; the eyelids are half closed, and sometimes there is lachrymation and petechiae on the conjunctival mucous membrane. The mucous membranes are coloured more or less yellow; the urine is thick and of a dark-yellow up to a reddish-brown colour; sometimes it contains albumin. The percentage of haemoglobin may fall down to 35. Decomposition sets in quickly after death and the fat and the serous membranes are stained yellow: there is then seen congestion of the internal organs, enlargement of the spleen, and serous exudate within the pericardial sac. The *P. caballi* of Turkestan was similar to that of other countries—single and bigeminate pear-shaped forms and rounded parasites.

In sheep the authors discovered piroplasms and Theileria in the case of slaughterhouse animals. Cases due to piroplasms were rarer than those due to Theileria. The piroplasms were of the large pear-shaped form and there was never more than one parasite in a single red corpuscle.

DSCHUNKOWSKY and LUHS (1907) first observed ovine piroplasmosis in the Transcaucasus, where the disease causes great losses. Yakimoff believes that according to the figures published by these two authors they were dealing with a mixed infection due to piroplasms and Theileria. The same authors (1909) discovered in the Transcaucasus a disease of goats in which they described small rounded-oval or elongated-oval parasites smaller in size than those found in sheep. It is probable that these also were not piroplasms but Theileria. SCHELLHASE (1913) described cases of goats infected with parasites of the type *Theileria mutans* in German East Africa. In a single case Yakimoff discovered a fairly large intracorpuscular parasite resembling a piroplasm in the blood of a goat in Turkestan.

The blood and spleens of a large number of dogs in several towns were examined but no case of piroplasmosis was discoverable.

On the other hand, piroplasmosis appears to be very widespread among wolves. In the slaughterhouse at Taschkente 75·9 per cent. were found infected. The degree of infection varied; as a rule the infection was latent and the parasites very rare. The parasites occurred as ring-shaped, small pear-shaped, and rarely rod-shaped forms; elements in the form of a Maltese cross were seen. Theileria and anaplasms were observed in conjunction with the piroplasms. The average size of the piroplasms was in the case of the rounded forms 1·42, bacillary forms 2·13, pear-shaped forms 1·5$\mu$. Sometimes eight parasites could be seen in one corpuscle. In the case of one wolf killed on the Afghan frontier parasites resembling *P. canis* were found. It is recalled that NUTTALL and GRAHAM-SMITH failed to infect jackals with *P. canis*. PATTON (1910) discovered piroplasms, *P. gibsoni*, in Madras jackals and dogs, and NUTTALL (1910) found a piroplasm, *P. rossi*, in an African jackal.

*Theileriases.*—The authors noted some acute cases of theileriasis in bovines. Two animals were seen with a high temperature and general depression, but no other symptoms. Eighty per cent. of the red corpuscles were found invaded on examination of blood smears. After a few days the temperature became gradually lower and the number of parasites diminished but they did not disappear completely. In Turkestan there thus exist two forms of theileriasis, viz., an acute and a chronic form; the former lasts a few days and then becomes chronic; in the latter condition the parasites did not disappear entirely from the blood. The mild nature of the disease and the presence of parasites in the blood of healthy animals indicate that the Theileria of Turkestan is not *Th. parva*, but perhaps *Th. mutans* or a variety of this species. Calves inoculated with large quantities of infected blood developed in a few days a small number of Theileria which persisted but did not increase in number. Neosalvarsan and trypan blue injected intravenously failed to cause the disappearance of the parasites.

Theileria were found in smears from the blood of sheep killed at the Taschkente abattoirs. They were oval or pear-shaped in form, 1·5$\mu$ in length, with a small chromatin dot; rod-shaped parasites were very rare. Similar parasites have been described in sheep by SCHELLHASE (1913) in German East Africa, by MACFIE (1914) in Nigeria, and RODHAIN (1916) in the Belgian Congo. They were called *Theileria ovis* by the last-named author, and also prior to that date by Yakimoff in 1914.

Blood parasites which were believed to be Theileria (*Th. camelensis*) on account of their morphological characters were found in the blood of three camels. They were rounded in form with lightly staining reddish chromatin, few in number, and always occurring singly.

In the blood of one fox out of several examined a few Theileria were found in the form of rings each with a mass of chromatin.

*Nuttalliases.*—Several cases of nuttalliasis either alone or associated with piroplasmosis were found among horses. Clinically there was high temperature up to 41° C. or more, accelerated pulse (100), depression, jaundice, but no haemoglobinuria as in the case of the infection due to *P. caballi*. In blood smears four parasites were sometimes found together assuming the shape of a Maltese cross. One case was treated successfully by means of trypan blue, although THEILER states that this drug has no action upon *Nuttallia equi*. These parasites were found in about 2 per cent. of the horses killed at the Taschkente abattoirs; they were rounded or ring-shaped, rarely pear-shaped. The round forms were 1·42 to 2·48$\mu$ in diameter, the pear-shaped forms 0·71$\mu$ to 1·42$\mu$ × 1·42$\mu$ to 2·13$\mu$. Nuttalliasis was found by DSCHUNKOWSKY and LUHS in the Transcaucasus.

Several cases of nuttalliasis were found among asses in one district. The parasites were rounded or slightly oval, and sometimes pear-shaped. The chromatin was well-developed. No division into four daughter parasites was observed. This disease was also observed in asses by DSCHUNKOWSKY and LUHS in the Transcaucasus.

*Anaplasmoses.*—Out of 193 bovines examined in one locality Theileria alone were found in the blood smears of 147, Theileria and anaplasms in 13, and anaplasms alone in one case only. The infection in bovines was probably first observed by STOLNIKOFF (1908), who

mistook the causal organism for *Piroplasma annulatum*. *Anaplasma marginale* was the only form seen and never *A. centrale*. The parasites were of a regularly rounded shape and occurred singly and, rarely, in twos within the red corpuscles; sometimes forms undergoing division in the shape of a dumb-bell were seen. When associated with piroplasms the anaplasms were rare but they were numerous in the case of pure anaplasmosis. They stained of a deep violet colour with Giemsa, and were from 0·5 to 1·25$\mu$ in diameter.

Anaplasms were found in two horses, in one case associated with *N. equi* and in the other case alone. No anaplasms were found in asses.

The first case of anaplasmosis discovered by Yakimoff in dogs was found in a case severely infected with naturally-contracted leishmaniasis. Two other dogs inoculated with an emulsion of the organs of this dog became infected with leishmaniasis but not with anaplasmosis. Several cases of anaplasmosis were afterwards seen in dogs, but never in sheep and goats.

STOUTE (R. A.). **"Piroplasmosis" "Equine Malaria."**—*Jl. Amer. Vet. Med. Assoc.* 1917. May. Vol. 51. (New Ser. Vol. 4.) No. 2. p. 239.

A mare imported into Barbados, West Indies, from St. Croix showed symptoms commencing with inappetence six days after landing; two days later the appetite had disappeared. The following symptoms were then observed:—the conjunctival, buccal, and genital mucous membranes presented a yellow appearance; lachrymation; intermittent hurried pulse; quickened respiration; temperature 108° F.; great disinclination to move; marked constipation. The respiration was very rapid just before death. The blood smears, which were examined by the Bureau of Animal Industry, showed numerous piroplasms. The author is unable to suggest how this disease appeared in the West Indies.

(d) TRYPANOSOMIASIS.

HORNBY (H. E.). **Transmission of Cattle Trypanosomes by Flies other than Tsetse.**—*Rhodesia Agric. Jl.* 1917. Apr. Vol. 14. No. 2. pp. 168–176. With 1 plate comprising 2 figs.

In this article Hornby refers briefly to the existing knowledge with regard to the classification and transmission of trypanosomes. In Central Africa it has been shown that where the tsetse fly exists one always expects to find the domesticated animals affected with trypanosomiasis, and the same applies to Rhodesia. MONTGOMERY and KINGHORN (1908), however, concluded that "trypanosomes may be transmitted by *Glossina morsitans, Stomoxys calcitrans*, and a specimen of Lyperosia." BEVAN (1910), on the other hand, maintained that trypanosomiasis did not spread in the absence of the tsetse fly.

The author states that experience with fly-struck cattle in almost every part of N.E. Rhodesia, and in the adjoining parts of N.W. Rhodesia, Nyasaland and Portuguese East Africa has shown him that the vast majority of fly-struck cattle in these areas are infected with *T. pecorum*; only comparatively few were found to harbour *T. brucei*

or *T. vivax*, although these trypanosomes are well represented in other parts of Rhodesia. In a district where *T. pecorum* and *G. morsitans* are both common it has been stated that if all the mammals and flies are examined only comparatively few of each lot would be found to harbour trypanosomes, nearly all the infected mammals being ruminants and all the affected flies being Glossina. Further, not all ruminants, nor all tsetse flies are susceptible, and in any fly belt it is exceptional to find more than 50 per cent. of the ruminants and 5 per cent. of the flies infected. Various authors have demonstrated that trypanosomes in other parts of the world can be and frequently are transmitted mechanically by flies other than tsetse flies. It remains to be shown that the Central African trypanosomes are often transmitted in a similar manner. Jowett (1910 and 1911) showed that outbreaks of trypanosomiasis due to *T. congolense* (*pecorum*) frequently occurred in Portuguese East Africa in localities containing no tsetse flies but into which some animals had been brought from a distance and had been submitted en route to the attack of one or other species of Glossina; he further showed that Stomoxys or Haematopota were capable of transmitting the trypanosome mechanically. Owen (1914) demonstrated that trypanosomiasis of cattle in N.W. Rhodesia was spread by a species of Tabanus; and Jones (1915) showed that the disease was spread in cattle near Beira by Tabanus or Hippobosca. Balfour in the Sudan and Bruce in Nyasaland were both convinced of the important part that mechanical infection may play in spreading outbreaks due to *T. pecorum*; the latter observer blames Tabanus and Haematopota but considers that the evidence that Stomoxys plays a similar rôle is unsatisfactory. Braun (1914) in German East Africa stated that it was possible that in addition to tsetse flies other biting insects (Stomoxys and tabanids) transmitted *T. pecorum* (*congolense*).

In 1914 the author inoculated a dog with a strain of *T. brucei* vel *rhodesiense*; the dog afterwards showed numerous trypanosomes in the blood. The dog was allowed to cohabit with another dog, while the attacks of Stomoxys and haematophagous muscids caused severe excoriation of their ears. The uninoculated dog, subsequently fell ill and blood examination revealed numerous trypanosomes similar to those found in the other animal.

"The farming district of Fort Jameson is a 'fly-free' area almost completely surrounded by 'fly.' It is not a matter for surprise then that outbreaks of trypanosomiasis are constantly being reported from its periphery. I was soon impressed with the disproportion between the large number of animals affected and the small number (frequently *nil*) of tsetse that had been seen in the neighbourhood of the outbreak. Making all allowances for bad herding and straying cattle, it seemed impossible that, as was frequently the rule, an entire herd of fifty cattle could be infected by tsetse that no one had ever seen. Granted that the initial cause of the outbreak was a beast struck by a stray tsetse, it seemed probable that the disease was spread in the herd by some other agency. Then again, I have travelled through a district in December, just as the rains were starting, and of a thousand village cattle examined I have found less than a dozen to be fly-struck. I have travelled in the same district six months later, and found that five hundred of those previously examined were either dead or very ill from trypanosomiasis—on neither journey did I see a tsetse fly, although I know that from time to time odd ones are to be seen close to the district in question. This seasonal occurrence of the disease, coincident with the biting fly season, is significant."

The author then adds that in other districts where tsetse flies were scanty a large proportion of cattle became affected with trypanosomiasis. As experience has shown that less than 5 per cent. of Glossina are infective the large number of cases could not be entirely attributable to them. On some estates where the danger from mechanical infection has been realised and measures taken to isolate all fly-struck cattle, no fresh cases occurred during the last summer, although during each of the three previous ones severe outbreaks had been the rule.

The following footnote to this article is added by the Chief Veterinary Surgeon, Southern Rhodesia :—

"With regard to the conclusion that in certain circumstances trypanosomiasis in domestic animals is transmitted by biting flies other than tsetse, whilst this may be true for some areas, it is a very rare occurrence in Southern Rhodesia, where, as the result of the practical observation—no tsetse, no trypanosomiasis—it has not been found necessary to impose any veterinary regulations in respect to this disease."

MAYNARD (G. D.). **The Trypanosomes of Sleeping Sickness; being a Study of the Grounds for the Alleged Identity of *T. brucei* with those causing Disease in Man in Nyasaland.**—*The South African Institute for Medical Research. Publication No. 6.* 39 pp. With 1 table & 26 charts. Dec. 17. 1915. Johannesburg.

This publication consists of a detailed criticism of the findings of the Sleeping Sickness Commission of the Royal Society in its Report No. 16 [see this *Bulletin*, Vol. 3, No. 1, pp. 5–12]. "The Commission having satisfied itself that the Sleeping Sickness of Nyasaland and Rhodesia is caused by a trypanosome which, it states, is common in all fly-country and is spread from wild animals to man, recommends that efforts should be made to diminish, as far as possible, the number of wild animals in fly-areas."

Reference is made to the difficulties involved in exterminating game from the known African fly-areas and for the above recommendation to be valid two suppositions must be confirmed, viz. :—"(*a*) that wild game in all districts where *G. morsitans* is found are carriers of the trypanosome causing human trypanosomiasis, and (*b*) that if the game is eliminated the smaller animals will not act as carriers." Many ambiguities in the Commission's report are revealed by the author, and careful consideration of the far-reaching conclusions is advised before African governments should endeavour to carry them into effect.

The Commissioners consider that the morphology of the trypanosomes studied is a most important point, especially as regards length, and the numerous graphs of frequency-distributions of length-measurements indicate the value they place on this method of examination for the purpose of classification. Maynard points out that in common with other writers they "have discussed this point entirely from an inspectional standpoint, and appear to be unacquainted with the methods of the scientific analysis of such distribution, or of the statistical laws on which alone can sound deductions as to similarity or dis-similarity be based."

Karl PEARSON had already pointed out the great chances of error that might arise when trypanosomes are considered to be identical simply

according to the method adopted by BRUCE and his colleagues. The greater part of the present paper is devoted to an intricate mathematical analysis, on the same lines as suggested by PEARSON, of the graphs of the various trypanosomes given in the Commission's report.

The author concludes from this study—

"1. That the analysis of length distributions shows that the dimorphic trypanosomes dealt with, viz., *T. rhodesiense*, *T. brucei*, *T. gambiense*, Trypanosomes of Nyasaland Sleeping Sickness, and Nyasaland wild game strain, have certain features in common. With some exceptions, which are not confined to any particular strain, the general character of resolution is similar.

"2. That there is some evidence to suggest that there is less similarity between the Nyasaland human strain and *T. brucei* than between *T. rhodesiense* of Stephens and Fantham and *T. gambiense* as recorded by these authors.

"3. That the analysis suggests that uniformity in treatment of strains, prior to the inoculation of rats, from which measurements are made, may be an important factor in determining the mean size and the variability of the components of the distributions.

"4. That at present no valid argument in regard to the identity or otherwise of *T. brucei* and the trypanosome causing disease in man in Nyasaland can be drawn from length-measurement-distributions.

"5. That this method of investigation may probably prove of service in the study of trypanosome species when proper analytical methods are employed at the time the investigations are being undertaken, but that nothing of value can be expected from an uncritical examination, or mere inspection, of the crude distributions."

The pathogenicity tests on laboratory animals of the various strains of trypanosomes studied by the Commission are then discussed and from the data the author infers "that at present the only valid argument in favour of the identity of the trypanosomes causing disease in man in Nyasaland with *T. brucei* is to be drawn from such experiments. There is some doubt, however, as to what weight should be attached to differences in period of illness before death, and, moreover, whether any stress should be laid on similarity in this respect in the absence of confirmation by other methods of investigation."

No differences in the trypanosomes can be noted by studying the carrier question. *T. rhodesiense* may be carried by *G. morsitans* and *G. brevipalpis*, *T. brucei* by *G. morsitans* and *G. pallidipes*, *T. gambiense* by *G. palpalis* and *G. morsitans*. The cycle of development in *G. morsitans* is similar for *T. brucei*, *T. rhodesiense* and *T. gambiense*.

With regard to cross immunity tests the experiments carried out by the Commission indicate that *T. brucei*, the Nyasaland human strain, the Nyasaland wild *G. morsitans* strain, and *T. rhodesiense* were not identical. Moreover, experiments carried out in the same direction by LAVERAN and NATTAN-LARRIER and MENSIL and LEGER tended to show that *T. rhodesiense* is not the same as *T. brucei*, and that a closer relationship exists between *T. gambiense* and *T. rhodesiense* than between *T. brucei* and either of these trypanosomes. Such experiments on the effects of various immune sera as have been undertaken "negative the supposition that *T. brucei* is identical, or even closely allied to the trypanosome causing Sleeping Sickness in man."

The importance attached to geographical distribution is indicated by the following quotation :—"The Commission thinks that, in addition to the morphology and action on animals, the geographical distribution of 'Nyasaland sleeping sickness,' or '*Trypanosoma brucei* disease'

is the only way—experiments on man being impracticable—of showing that *Trypanosoma brucei* and *Trypanosoma rhodesiense* are one and the same." The author states—

"9. That there is no evidence at present from the known geographical distribution of *T. brucei* to suggest that it is a cause of Sleeping Sickness in man; and that even if it were found to produce disease in man this would, of itself, constitute no greater argument in favour of its identity with the Nyasaland human trypanosome than with *T. gambiense*.

"10. From the foregoing it would appear, therefore, that there is very little scientific evidence to support the contention that *T. brucei* and the trypanosome causing Sleeping Sickness in Nyasaland are the same species, while there are some very valid reasons for regarding them as distinct. Although the question may still be considered *sub judice* there does not seem to be any justification for entertaining a bias in favour of their identity. If this be admitted it follows that the recommendations of the Commission, which are based on their assumed identity, do not rest on a sure foundation of fact."

The author then enumerates a few hypotheses which suggested themselves in the course of this study as possible explanations of some of the facts. A priori it is unlikely that the Nyasaland human trypanosome is a newcomer into the country and thus it may be that (1) the Nyasaland disease is caused by the *T. gambiense* and that the increased virulence is due to the change of the invertebrate host, (2) that the human strain is derived from the wild game strain of the country, and (3) that it is the result of a dual infection with say, *T. gambiense* and a game strain. Various arguments in favour and against these theories are brought forward.

"It may be pointed out that unless an unmodified game strain be the cause of human trypanosomiasis—and the weight of evidence appears to me to be against this view—the human carrier is of much greater importance than the wild animal, and consequently the recommendations of the Commission cannot, unless considerably modified, be accepted as a satisfactory solution. The wholesale destruction of the big game of Africa cannot be accomplished without profoundly affecting the economic position in this Continent, nor, even if it could be satisfactorily carried out, can any positive guarantee at present be given that the situation in regard to Sleeping Sickness would be improved."

TEICHMANN (Ernst). **Mischinfektionsversuche mit Trypanosomen.** [Mixed Infections with Trypanosomes.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Nov. 23. Vol. 82. No. 3. pp. 511–526. With 6 tables.

"The manner in which mixed trypanosome infections behave in mice was first investigated by A. LAVERAN and D. ROUDSKY (1912). They obtained strains without centrosomes from *Trypanosoma brucei*, *Trypanosoma evansi*, and *Trypanosoma soudanense* by the action of oxazine on these parasites. Such parasites mixed with normal individuals of the same strains were completely eliminated in from 2 to 10 mice passages. Afterwards R. OEHLER (1914) showed experimentally how artificially mixed infections with trypanosomes conducted themselves in mice. OEHLER obtained a pure strain by means of single cell transmission of a nagana strain (No. 4) maintained in our Institute. One branch of this strain was made drug-fast against salvarsan and another against tartar emetic, while another was not treated and thus remained sensitive to drugs. Each of the drug-fast subsidiary strains were then mixed with the drug-sensitive strain, inoculated into mice, and then carried on in these animals. In the course of passages the trypanosomes became separated and it always happened that the drug-fast components of the mixed infection gradually disappeared. OEHLER makes the difference in multiplication responsible

for the separation and he expresses the opinion that all acute strains 'that have been carried on for several passages must be regarded as pure—as pure as if they had originated from a single trypanosome.'"

It was obvious that in the course of passages a more quickly multiplying strain would ultimately lead to the suppression of a more slowly dividing trypanosome provided that the greater multiplication was also combined with stronger virulence. The question arises, however, as to what would happen in the case of a mixed infection with two or more strains possessing approximately the same power of multiplication and toxicity. The experiments described by the author in this paper were performed with the object of solving this problem.

Two nagana strains named Strain 4 and Strain 90 F1., respectively, were used; these had been maintained in rats or mice and possessed approximately the same virulence in that they both killed mice in from four to six days after inoculation. Neither of these strains had been submitted to the action of any drug but Strain 4 had been shown to be very insensitive towards arsenic, while the other strain remained quite sensitive. The two strains also possessed immunological differences in that a serum immune against one strain had no protective powers against the other. Equal quantities of these two strains were then inoculated into five mice and a series of the passages made from each of these mice. At various passages the nature of the infective organisms was ascertained by determining the curative action of the sera immune against each of the original components on inoculated mice; the arsenic-fastness of the organisms was also tested by injection with arsacetin. At the 6th passage both elements were present in every case. In the case of one of the mixed strains the arsenic-fast element had become eliminated in the 10th passage; in the case of the other three mixed strains carried on both elements remained for a longer time, but at the 20th or 21st passage it was found that only the arsenic-fast strain remained; the remaining mixed strain was lost.

In order to make sure that one element had not been missed because of the small number present in the peripheral blood experiments were next made using for transmission the heart blood of infected mice 24 hours after inoculation, and tests were made at various passages as before. Separation, however, took place in the same way, but after a greater number of passages and this would probably be accounted for by the fact that the passages were made more quickly.

The question now arose as to whether a separation would take place in the case of two equally virulent trypanosome strains which set up a chronic infection after inoculation into mice. Tests by means of specific immune sera would not be possible in this case as the strains undergo marked antigenic changes in the course of a chronic infection. It is, however, possible to perform the experiment by utilising two trypanosomes which present morphological differences. Thus, a strain of *T. brucei* (Strain 63) obtained by the author from an ox in German East Africa, and the small East African trypanosome, *T. congolense* (Strain B), were used. Both these strains took about 30 days to kill a mouse; the remission period occurred earlier, about the 7th day, in *T. brucei* than in the case of *T. congolense*, 14th to 16th day. Mice inoculated with equal quantities of these chronic strains were examined daily as to the relative proportion of large and small

trypanosomes in the blood. Sub-inoculations were made when they were present in equal quantities and also when one element considerably exceeded the other or was apparently absent under the microscope. In the case of the mixed strain obtained from one mouse separation occurred rather early, but in the case of the other four mixed strains it was not possible to obtain any separation although the experiments were carried on over three months.

Mixed infections are known to occur naturally. YORKE and BLACKLOCK (1911) observed a horse infected with *T. vivax* and *T. dimorphon*. BRAUN and TEICHMANN produced a mixed infection with *T. brucei* and *T. congolense* by feeding Glossina on rats at Amani, German East Africa.

The following are briefly the author's conclusions :—

"(1) In the case of a mixed infection with two equally virulent acute nagana strains separation takes place in the course of a few passages through mice.

"(2) The separation may take place by the elimination of one or other component.

"(3) Difference in sensitiveness of the components towards arsacetin exercises no appreciable influence on the direction in which the separation may take place.

"(4) The separation of two equally virulent nagana strains is also not prevented if the heart blood of the mice infected with the mixed strains is used for sub-inoculation.

"(5) In the case of mixed infection with strains (*T. brucei* and *T. congolense*) producing a chronic disease in mice separation of the components does not take place in consequence of the remissions which occur.

"(6) Exceptionally a separation can take place if one of the two components is indeed carried over in the course of sub-inoculation, but does not infect."

YAKIMOFF (W. L.) & WASSILEVSKY (W. J.). **Essais biologiques sur le luargol (102 de Danysz). Traitement de la dourine expérimentale des souris.** [Biological Tests on Luargol (Danysz's 102). Treatment of Experimental Dourine of Mice.]—*C. R. Soc. Biol.* 1917. Apr. 21. Vol. 80. No. 8. pp. 387–388.

The effects of luargol (an organic arsenical compound containing antimony, bromine, and silver) as well as its disodic compound were examined by the authors on normal mice and on mice infected with the Russian strain of dourine. It was found that 1 cc. of a 1 in 250 solution when injected intravenously killed normal mice in two days after injection, but that mice survived the injection of 1 cc. of weaker solutions, 1 in 300 to up to 1 in 800. The minimum fatal dose was thus 4 mgm. for a mouse weighing 20 grammes, and the maximum dose tolerated 3·3 mgm. These results indicated that luargol is less toxic than German and Russian salvarsan.

Mice infected with dourine, injected intravenously with solutions of 1 in 600 up to 1 in 900, recovered and were kept under observation afterwards for 60 days. In the case of infected mice treated with weaker solutions, 1 in 1,000 to 1 in 2,000, relapses occurred in from 11 to 20 days. The therapeutic dose was thus 1 cc. of a 1 in 900 solution, or 1·1 mgm.

The therapeutic index or the ratio between the minimum curative and the maximum tolerated dose is thus 1 : 3, which is better than that of salvarsan. The authors conclude that 102 is a very good chemotherapeutic agent.

WEHRBEIN (Heinrich). **Die Diagnose der Beschälseuche mittels der Konglutinationsmethode.** [The Diagnosis of Dourine by Means of the Conglutination Method.]—*Arch. f. Wiss. u. Prakt. Tierheilk.* 1917. Apr. 14. Vol. 43. Nos. 2 & 3. pp. 233–238.

The conglutination test closely resembles the deviation of the complement test except that in the final reading clumping of the blood corpuscles instead of haemolysis serves as the indicator. The test was studied by STRANIGG as applied to the diagnosis of glanders and it was also applied by EHRLICH, BORDET, and STRENG to detect the presence of antibodies against various bacteria and other albuminous products.

Careful titration of the various reagents is necessary. The author uses fresh horse serum as complement. This loses its activity on standing after six to seven hours but in the case of a healthy horse its titer remains constant and need not be determined for each experiment. A horse is selected possessing a serum with the highest complement titer. Some horse-sera agglutinate the corpuscles to a high degree and should be avoided.

The sheep blood emulsion should be of constant thickness and is added in the proportion of 0·1 of a 5 per cent. emulsion.

The antigen consists of pure trypanosomes obtained by repeated centrifugation from the blood of infected rats. An emulsion of 1 in 100 is made up.

A suitable ox serum must be obtained for conglutinating the sheep blood corpuscles. The best titer is 0·1 when 0·1 horse-serum is used as complement with 0·1 of a 5 per cent. emulsion of sheep corpuscles.

The reaction is usually read off three hours after the addition of the inactivated ox serum and the sheep corpuscles. The suitability of each lot of antigen is tested with a serum from a known dourine-infected horse and from a known normal horse.

The serum to be tested must be sterile. Putrefaction or the addition of chemicals is fatal to the test. The sera are inactivated for half an hour at 59° C.

The reading of the test is easy in a good system. With a positive result all the corpuscles are clumped together and with a negative serum there is no trace of clumping.

Nineteen dourine sera gave positive results corresponding with those given by the ordinary deviation of the complement test, and to a large extent with the agglutination test, with one exception in which an animal that had been infected for a considerable time and had then been treated with atoxyl ceased to give a positive result with the complement test, but continued to react strongly according to the conglutination test. Thirty normal sera gave negative results, except at first in two cases where errors of technique were detected.

The author's conclusion to a very incomplete description of his test is as follows :—

"The conglutination test is applicable for the diagnosis of dourine sera, but it is more sensitive to errors, and therefore more difficult to carry out than the ordinary deviation of the complement method."

DYKINS (W. A.). & JONES (R. P.). **Experiments conducted with a View to ascertaining the Toxicity of Certain Drugs injected Intravenously, and the Action of Same, if any, on Trypanosomes causing Trypanosomiasis in German East Africa.**—*Vet. Record.* 1917. Apr. 7. Vol. 29. No. 1500. pp. 415–416.

Nearly all the animals of the regiments in the veterinary charge of the authors were infected with trypanosomiasis, and, as no hope was entertained of their recovery, some experiments were performed on animals in the last stages of the disease with the object of ascertaining the minimum toxic doses of certain drugs when administered intravenously.

No toxic effects were observed after the administration of 25 grains of arsenic, 500 cc. of a 1 in 1,000 solution of perchloride of mercury, fifteen grains of arsenic and 200 cc. of a 1 in 1,000 solution of perchloride of mercury, 150 cc. of a 2 per cent. solution of calx chlorinata, 100 cc. of hypochlorous acid, 300 cc. of a 1 per cent. solution copper sulphate. "All the animals which died died of trypanosomiasis and not as the result of the injections." The minimum toxic dose was not definitely ascertained in any case. "Except in cases injected with the solution of copper sulphate, the effects of which are open to doubt, in no case did we discover any drug with an inhibitory action on trypanosomes."

DELANOË (P.). **Contribution à l'étude du pouvoir pathogène du Trypanosome de Mazagan.** [Pathogenicity of the Mazagan Trypanosome.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 501–512.

In this memoir the author discusses the susceptibility of the various laboratory animals to subcutaneous or intraperitoneal inoculation of virus obtained from the naturally infected horse.

*Rabbit.*—All rabbits inoculated proved susceptible and the disease ran a more or less chronic course. Death occurred in from 2 to 11 months. The trypanosomes could be demonstrated only at irregular intervals in the peripheral blood, and generally they were few in number. Auto-agglutination of the red blood corpuscles is very distinct and may exist before the trypanosomes appear in the blood.

Severe external lesions appear commencing from 20 to 25 days after inoculation. These first take the form of marked swellings of the conjunctival and nasal mucous membranes together with the formation of crusty muco-purulent discharges on these places. No keratitis, however, appears. The ears become tumefied and hairless and filled with dried-up scaly crusts. Hairless, crusty, symmetrically-placed patches appear on the dorso-lumbar region. Lesions of the genital organs are also distinct, the sheath and the vulva becoming swollen, dry, wrinkled, and crusty in appearance. These lesions become progressively intense during the course of the disease, but the appetite remains normal throughout.

On post-mortem examination no swelling of the spleen is observable; the liver, however, is congested and enlarged, and often attacked with fatty degeneration. In one case the heart was found affected with very advanced fatty degeneration.

*Guinea-pig.*—A small number of guinea-pigs, infected with the trypanosome after a series of passages through various experimental animals, all proved susceptible and death occurred in from 36 days up to 4 months after inoculation. The trypanosomes could be found at certain periods only in the peripheral blood but when present they were nearly always very numerous. The trypanosomes disappeared abruptly from the blood during the crises. The external lesions were less marked than in the case of the rabbit. The most marked lesions consisted in an intense oedema along the inguinal and external genital regions.

*Dog.*—This animal is very susceptible contracting a sub-acute infection. The period of incubation was about eight days, and death, which occurred in all cases, took place in from two to four months after inoculation. When present in the blood the trypanosomes are numerous, but they may disappear abruptly from time to time. Auto-agglutination of the corpuscles is often very pronounced and may appear before the trypanosomes in the peripheral blood. The trypanosomes also become agglutinated, forming relatively large clumps.

One dog out of three showed a double keratitis, but no swelling of the eyelids or conjunctiva, and this animal became affected also with multiple abrasions on the fore quarters. The other dogs showed no such lesions. In all cases the animals became affected with a gradually progressive loss of condition until they finally became extremely emaciated, affected with partial paralysis of the hind quarters and respiratory distress.

On post-mortem examination there is distinct swelling of the spleen, and swelling and degeneration of the liver.

*White mouse.*—This animal is invariably susceptible, but, according to the virulence of the trypanosome, it may show two distinct types of infection; that is, after a period of incubation there may be a continuous and progressive multiplication of the trypanosomes in the blood up to the time of death, or, on the other hand, the disease may run a more prolonged course accompanied by crises or recurrent appearance and disappearance of trypanosomes in the blood. The first type of infection was set up after inoculation with the primary virus obtained from the horse and also in successive passages through mice; the second type was observed after passing the virus beforehand through the dog and rabbit. The period of incubation thus varied from 2 up to 9 days, and the course of the disease was from 6 to 36 days, death taking place after the shortest interval when the trypanosome had been passed through a series of five mice. Auto-agglutination was not very marked. On post-mortem examination the spleen showed marked enlargement.

*White rat.*—The period of incubation was about 5 days and death occurred in from 18 to 23 days after inoculation from a naturally infected horse, but after three passages it occurred in 5 days. The infection is thus acute in this animal. Very marked swelling of the spleen and congestion and fatty degeneration of the liver is observable in the dead animals.

*Alexandria rat.*—The infection may be acute or chronic. After infection with virus from a white rat death took place on the 6th day with extremely numerous trypanosomes in the blood and enlargement

of the spleen. On the other hand a rat inoculated with virus from a gerbil after passage through a long series of other animals showed a very typical chronic infection, with trypanosomes rarely present in the blood and subsequent recovery.

*Gerbil.*—This animal is very susceptible, the period of incubation being only from 2 to 3 days. The trypanosomes are very numerous on the 4th day, and then show distinct agglutination. Auto-agglutination of the corpuscles, however, is not observable. One female gerbil gave birth, after inoculation, to seven young, which remained healthy. The mother which in the meantime showed distinct lesions about the nostrils was eaten up after death by her grown-up progeny, and two of these became subsequently infected with trypanosomiasis. Infection by ingestion of an infected dead animal was also shown in another experiment; the period of incubation in this case lasted from 8 to 11 days.

Inoculation of large quantities of virus into fowls and geese gave negative results.

DELANOË (P.). **De l'existence à Mazagan et dans le Cercle des Doukkala (Maroc Occidental) de *Trypanosoma Lewisi* Kent et de *Trypanosoma Duttoni* Thiroux.** [The Presence of *T. lewisi* and *T. duttoni* in Western Morocco.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 456–458.

*T. lewisi* was very commonly found by the author in rats (*Mus alexandrinus* Geoffroy) caught at Mazagan and in various outposts in the Doukkala district. In certain places almost all the rats were infected. No trypanosomes were, however, found in the gerbils which are very common in this region. *T. lewisi* was, on the other hand, shown to be infective for these animals. Two gerbils thus inoculated intraperitoneally with infected rat blood developed in one case an infection for a short period confined to the peritoneal cavity, and in the other case the trypanosomes became generalised but here also the infection was mostly intraperitoneal and lasted only fourteen days.

*T. duttoni* is much less common at Mazagan than *T. lewisi* Out of 43 grey mice (*Mus musculus spretus* Lataste, 1883) one only was found infected. In smears stained by the Pappenheim method the trypanosome showed a thin lightly coloured undulating membrane, a blue cytoplasm without chromatinic granules, a rose-coloured nucleus and flagellum, and a deep violet blepharoplast. The dimensions were, total length 35·4$\mu$, free flagellum 6·3$\mu$, posterior extremity to blepharoplast 6·5$\mu$, blepharoplast to nucleus 8·3$\mu$, length of nucleus 4·3$\mu$. The trypanosome was easily maintained by passage through grey mice.

NOVY (F. G.), DEKRUIF (P. H.) & NOVY (R. L.). **Anaphylatoxin and Anaphylaxis. I. Trypanosome Anaphylatoxin.**—*Jl. Infect. Dis.* 1917. May. Vol. 20. No. 5. pp. 499–535. With 1 fig., 18 tables & 2 charts.

**"In the course of experimental work on immunity against the trypanosomes of surra and nagana it was found that severe toxic effects with marked hypothermia often followed the injection of autolyzed suspensions of the organisms. When such injections were repeated the chronic intoxication thus induced usually ended fatally, and while a certain minimal**

protection could be established in carefully treated animals, it was evident that the poisonous action observed was a bar to the production of a higher degree of immunity. As no advance seemed to be possible without a clear understanding of the nature of this intoxication, the trend of the investigation had to be changed into a new direction. At first the poisonous effects were identified with the 'trypanotoxin' of Laveran, but the similarity to that of the so-called anaphylatoxins was such that it led to a study of trypanosomes in their relation to the production of this poison."

The authors describe experiments dealing with anaphylatoxin-production with the surra, caderas and dourine trypanosomes, and *T. lewisi*. The nagana trypanosome is dealt with in greater detail. The methods employed in obtaining fresh serum aseptically from white rats, which were used most largely for experiment, and from guinea-pigs and rabbits are described.

The following is the authors' own summary of their experiments :—

"Anaphylatoxin was produced by 5 different trypanosomes, including the nonpathogenic *T. lewisi*.

"It is made not only by the living cells, but also by the dead, more or less autolyzed, cells, and even by such when heated to 60° C.

"The same mass of trypanosomes can be used repeatedly to toxify different lots of serum without apparently any limit to their inducing power. This serial production in one experiment extending over 8 days, was carried through 20 tests with no indication that the organisms were weaker than at the beginning.

"Rat serum is preferable to guinea-pig serum since it yields a poison which may be 12 or more times as active as that obtained with the latter; the respective lethal doses being 0·25 cc. of the former and 3 of the latter.

"The speed of poison-production under favorable conditions is very rapid and quickly reaches a maximum, the poison then persisting for a long time. Thus, infected defibrinated rat blood or serum, when incubated for 1 or 2 minutes, may become fatally toxic. With an incubation of about 15 minutes, it is possible to produce a toxic serum such that 0·25 cc. will cause acute anaphylactic death.

"Sera inactivated at 56° C. or 60° C. for half an hour apparently can be toxified.

"The anaphylatoxin was found to persist at 37° C. for more than 4 hours; at about 0° C. it may persist for an indefinite time. Thus, a surra serum was still toxic after icing for 171 days; a nagana serum was likewise active for 35 days. Attempts at detoxifying by addition of normal serum, bile, or cholesterin resulted negatively.

"Toxic sera can induce toxicity in normal sera, the mixtures representing a high dilution of the former. This result is not due to the action of a ferment, but to minute amounts of trypanosomes still present in the inciting serum; or, in the case of very prolonged incubation, to the production of autoanaphylatoxin.

"A comparison of the effects of different centrifugation-rates on chilled, rapidly defibrinated blood shows that sera obtained at slow speed readily become toxic; the sera secured at a very high speed do not.

"Transfusion experiments indicate the possible presence of anaphylatoxin in heavily infected rats. The formation of this poison in corpore may lead to sudden deaths or to chronic intoxication or cachexia.

"The injection of normal rat serum into infected guinea-pigs does not result in the in-vivo production of poison; any effect observed is due to the primary toxicity or autoanaphylatoxin of such injected serum.

"The toxicity of trypanosomal sera, when tested at regular intervals, appears to show more or less oscillation. Similar variations are met with in tests with anaphylatoxins produced by other agents, and even in normal sera. They are not due to changes in the amount of poison, but to varying resistance of the test animals.

"The injection of large amounts of washed trypanosomes into guinea-pigs may result in the production of anaphylatoxin in corpore. The effects are not due directly to the organisms, but to the disturbance in the colloidal state of plasma constituents, caused by the alien material.

"The 'trypanotoxins' are therefore disturbers of equilibrium; the result is a poison-production in vivo as well as in vitro. The mode of action of endotoxins in general will be found to be of the same nature.

"The participation of a ferment in this reaction is contra indicated by the speed of production, the rapid attainment of maximal level, the behavior of inactivated sera, and by the results of centrifugation.

"The syndrome of symptoms and autopsy findings consequent on the injection of the trypanosome anaphylatoxin are those of the intoxication of true anaphylaxis. The two poisonings are to be considered as identical."

MARTY (L.). i. **Agglutination et désagglutination des globules rouges dans la trypanosomiase.** [Agglutination and Disagglutination of the Red Blood Corpuscles in Trypanosomiasis.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 392–398.

ii. **De la Pseudo-Agglutination des globules rouges dans quelques affections à parasites sanguicoles.** [Pseudo-Agglutination of the Red Blood Corpuscles in some Diseases due to Blood Parasites.] *Ibid.* June. No. 6. pp. 484–486.

These papers refer presumably to phenomena which have been observed only in the case of human diseases; an extract is here given as the changes described may prove of interest for a comparative study in similar chronic blood affections of animals.

i. If an average-sized drop of normal human blood is placed between slide and cover glass the red corpuscles are observed to become formed into rouleaux from 10 to 50$\mu$ in length, in which the corpuscles are apparently held together side by side by two forces acting in inverse directions. These forces, however, prevent clumping of the corpuscles. When regarded by means of the naked eye the preparation presents at places a very finely granular appearance and shows a pale colour except at its border, where on contact with the air the blood has coagulated, forming a continuous haemo-lute preventing a too rapid evaporation.

If one looks through a preparation of trypanosome-affected blood one finds that it quickly takes on a granular appearance throughout; the granules are very much larger, and the preparation, instead of being pale, is of a smoky red colour. Between this distinct appearance of macroscopical agglutination and that of normal blood various degress of agglutination can be observed. In doubtful cases it is necessary to use a No. 7 objective or an oil immersion lens.

If after 5 or 10 minutes one exerts a moderately strong pressure by means of a glass rod or the finger on the preparations of normal and trypanosome blood one finds that the local and very fine granulation in the normal blood disappears and never shows itself again. In the case of the other preparation it re-appears and if the operation is repeated after 15 minutes the same phenomenon occurs; after half-an-hour the granulation becomes changed presenting a reddish sandy-like appearance which persists for several hours.

As the result of the clumping in the trypanosome blood a deeper colour bordering on mahogany is noticed; also, the agglutinated corpuscles withstand crenation and fragmentation into the so-called globulids longer than ordinary red corpuscles.

If one examines the preparation of normal blood under the microscope the red corpuscles at the periphery are formed up close together, forming a zone of corpuscles which soon commence to undergo successively crenation and haemolysis. The haemo-lute protects the preparation fairly well from contact with the air, but its impermeability being only relative all the red corpuscles in the preparation soon become crenated; they then disappear in a structureless deliquium which becomes invaded with air bubbles when the serum evaporates. From time to time corpuscles are seen capable of withstanding crenation longer and split into two or three elements of unequal size (globulids) which disappear last of all in the deliquium.

In a preparation of trypanosome blood one notices that the red corpuscles at the periphery, instead of undergoing crenation, form up into several layers somewhat resembling the superficial strata of the epidermis. The corpuscles in this stratum remain a long time intact and even show the appearance of a piece of mahogany with annular rings, etc. The haemo-lute is much more of an independent structure than that of normal blood; from the deeper surface of the stratum there are seen some prolongations which remind one of the intra-papillary prolongations of the skin. If an air bubble strays into the stratum it immediately becomes surrounded by the corpuscles which form an onion-like mass around it. Later, when evaporation of the serum has progressed to a certain extent the covering stratum loses its continuity and breaks up into pliable columns floating in the lemon-coloured serum. The deeper masses glide smoothly in between obstacles without becoming broken up until they reach the central parts of the preparation. This resistance to disagglutination is characteristic of perfectly agglutinating masses. Behind this covering stratum are formed smaller clumps which diminish in size and number as one approaches the centre of the preparation.

In the preparations submitted to pressure as above described one notices that in the case of normal blood the longer rouleaux are split up into two or three small columns. The first pressure in the other case has the effect of dividing the corpuscles into two classes, viz., those which contribute to the formation of clumps, and those which having insufficient agglutinating power are broken up into globulids. In the case of the clumps after the first pressure the heaped up rouleaux are broken up but as soon as the pressure ceases the various pieces become bound up together to form larger clumps with irregular margins surrounded by globulids. The central part of the clump is of a deep yellow, sometimes mahogany, colour; the thinner periphery is of a straw-coloured yellow. The haemo-lute is also broken up but forms up again into a less regular and incontinuous stratum.

The same phenomenon is repeated when pressure is exerted again a quarter or half an hour later. The evaporation of the serum is accelerated and the clumps take on new characters. The red corpuscles in order to escape desiccation become bound up more closely together and their contours become very irregular, the upper layers of corpuscles being in continuous active movement.

The third pressure performed half-an-hour later accentuates the binding together of the clumps. There are then formed within them clear spaces which appear in the form of crescents at the borders or in

the form of clear alveoli about the size of a corpuscle in the centre of a clump. The spaces may at times take on a copper colour.

A little later the vacuolisation of the clump is still more pronounced and it resembles an organ affected with fatty degeneration.

Towards the end, the massing of the corpuscles into clumps disappears; the attractive force becomes *nil*, and the clump spreads itself out. It is then seen under the form of sulphur-yellow flakes striated by the stellate outlines of the capsules of the red corpuscles. Last of all the striation or pattern work disappears and the clump undergoes a granular degeneration.

In order to study the phenomenon of agglutination-disagglutination it is better not to use a vaseline lute as this prevents the formation of the covering stratum. The most suitable drop of blood is that which only covers from two-thirds to three-quarters of the cover glass after slight pressure. Drops which cover the whole cover glass or only one-quarter to one-half are of no use for the study. After a first injection with atoxyl or, even better, following the injection of the second dose, the agglutination-disagglutination of the red corpuscles is increased to a marked extent. The phenomenon was not observed in other human diseases such as syphilis, yaws, malaria, and haemoglobinuric biliary fever.

ii. In other human affections due to blood parasites (spirochaetoses, malaria, and, to a lesser degree, in filariasis and in intestinal amoebiasis) an analogous phenomenon, which is less distinct and is hence called pseudo-agglutination, is observed in connection with the red corpuscles. In a very thin preparation this pseudo-agglutination is not seen. In a thick preparation the corpuscles form flakes of a laked appearance, more or less independent one from another. These may tend to cause confusion with the agglutination observed in trypanosomiasis. Preparations must be carefully made. An average sized drop of blood is placed on a slide and covered gently with a cover glass with the aid of a pair of forceps; a gentle and even pressure is exerted on the cover glass so as to spread the drop without crushing it.

Examined with the naked-eye the preparation shows no peculiarity. The rouleaux are slightly massed but there is no clumping by superposition. The alignment of the elements in the rouleaux is not perfect; in the neighbourhood of the haemo-lute the rouleaux are a little deeper in colour than normal, tend to collect together, and take on a varnished appearance. The same appearance is shown in slight trypanosome affections and in those which can be considered cured after a long treatment. After a shortly applied compression the rouleaux are broken up and do not form up again into mahogany-coloured spots. In the haemo-lute there are clusters of closely packed corpuscles but there is no stratum formation as in typical trypanosomiasis blood. Crenation of the corpuscles is more delayed than in the case of normal blood. The globulids are concomitants of the mahogany-coloured spots, that is to say, they are few and scattered in slight trypanosomiasis, but do not exist in cases of pseudo-agglutination.

The author attempted to intensify the agglutinating power of red corpuscles in trypanosomiasis so as to show up the mahogany-coloured spots more distinctly in the lighter forms of the disease. In a good preparation the blood covers about three-quarters of the cover glass

and around the haemo-lute there remains an empty space between the slide and cover glass. By means of a platinum needle bent at right angles a drop of 1 in 1,000 potassium carbonate is placed on the edge of the cover glass. This drop quickly comes in contact with the haemo-lute by means of capillary attraction. The haemo-lute in trypanosomiasis withstands disintegration very well while in the case of pseudo-agglutination it is almost immediately disorganised and carried away with the liquid currents. The lemon-yellow clumps of uncertain significance in slight trypanosomiasis become more distinct and of a mahogany shade. The pseudo-clumps do not resist; in the case of syphilis or acute malaria there may form in the centre of the preparation outside the limits of the currents small clumps of from five to six corpuscles with irregular ragged borders of a deep colour. A slight pressure exerted on the centre of the cover glass causes them to disintegrate and set free the crenated corpuscles which are carried away by the currents and prevented from re-agglutinating.

The author concludes that an examination for the phenomenon of agglutination-disagglutination with its accompanying globulids enables one to establish a diagnosis in the majority of trypanosomiases. In the milder forms recourse must be taken to a test injection with atoxyl or, much more simply, to impregnation with 1 in 1,000 solution of potassium carbonate; this potassium salt, by increasing the agglutinating power of the red corpuscles, enables one to differentiate between a very slight trypanosomiasis agglutination and a pseudo-agglutination due to some other infestation.

### (e) Miscellaneous.

Sanlorenzo (F.). **Coccidiose intestinale "dysenterie rouge" du boeuf en Piémont.** [Bovine Intestinal Coccidiosis or "Red Dysentery" in Piedmont, Northern Italy.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 446–447.

The above disease, which has been described by numerous authors in several countries, has not hitherto been recorded in Italy. Three cases of dysentery in cattle in the neighbourhood of Alessandria were found to have been caused by *Coccidium bovis* or *Eimeria zurni*, which was present in very large numbers in the faeces. The author believes that the disease is more widespread in Italy than is generally believed. Daily doses of 15 grains of thymol effected a cure in the author's cases.

Sergent (Etienne). **Sur des formes sans pigment ou à pigment très fin apparues chez le *Proteosoma* (*Plasmodium relictum* Grassi et Feletti) au cours de passages par canaris.** [Non-Pigmented Forms or Forms with Very Fine Pigment appearing in Proteosoma in the Course of Passage through Canaries.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 448–450. With 2 figs.

In the course of experiments on the immunity of birds towards Proteosoma peculiar forms were found in the blood corpuscles in rare instances (3 out of 700 canaries). The intraperitoneal injection of the infected blood from these cases into three other canaries reproduced the same forms. The parasites without pigment were young rounded forms capable of attaining a diameter equal to a third of that of the corpuscles. (In ordinary Proteosoma a large granule of black pigment

appears always as soon as the parasite becomes visible within the corpuscle.) The parasites containing very fine pigment were larger than the preceding, generally placed alongside the nucleus, which sometimes was not displaced; the pigment was appreciably finer than that of normal Proteosoma and this difference was especially seen when examined in the fresh state. Simultaneously with these two forms there were seen the ordinary forms of Proteosoma with a large amount of pigment but the forms without pigment or with very fine pigment were always more numerous than the classical forms.

It thus appears that the author had under observation certain forms of Proteosoma capable of being reproduced by inoculation in the bird and he argues that by analogy this observation lends support to Laveran's theory with regard to the unicity of the parasite of human malaria.

Sergent (Etienne) & Hempl (H.). **Sur l'immunité dans le paludism des oiseaux (*Proteosoma* vel *Plasmodium relictum* Grassi et Feletti).** [Immunity in Bird Malaria.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 550–552. With 1 chart.

In bird malaria due to Proteosoma there is after the commencing acute infection a period of relative immunity. A test inoculation —intraperitoneal injection of blood which is certainly infective for control birds—does not cause the parasites to appear in the peripheral blood. Sometimes only a short and benign relapse sets in, with at times a short incubation period (one or two days). This accounts for the so-called acclimatisation of the old inhabitants of a fever stricken country. This immunity is acquired from the 6th day after the commencement of blood infection.

In the experiments described by the authors five canaries infected at least 2½ years previously showed, in the case of four, that the relative immunity had lasted over this period. The fifth showed after the test inoculation a very marked infection.

Laveran, in discussing this paper, states that the disease of birds studied by the authors has nothing in common with human malaria and that it is unfortunate that it should be designated under the name of bird malaria.

Yakimoff (W. L.) & Schokhor (N. J.). **Leucocytogrégarine des chiens au Turkestan russe.** [Leucocytogregarine of Dogs in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 281–282.

The parasite described by the authors was identical with *Leucocytogregarina canis* James, 1905, and was found in 15 out of 151 dogs examined in various districts. The organisms were found in the peripheral blood, parenchymatous organs, and bone marrow. In the blood they were always intra-cellular, and in the organs almost always free-lying. They were of an elongated oval shape and slightly kidney-shaped. When stained each parasite showed a clear blue protoplasm containing sometimes a variable number of small granules, with a red-stained compact and finely granular nucleus situated sometimes towards one end. The membrane was colourless. A periplast was distinguishable.

Parasites belonging to the same species have been described by various authors in India, in the Malay States, French Indo-China, Lake Tanganyika, French Congo, Tunis, Baghdad, Italy, Algeria, and Corsica. Different species have been found in the blood of dogs in Upper Senegal and Nigeria, and Eritrea.

LEGER (M.) & MOUZELS (P.). **Hémogrégarine intraleucocytaire d'un saurien, *Tupinambis nigropunctatus*.** [A Haemogregarine found in the Leucocytes of a Lizard, *T. n.*]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 283–284.

The parasite described by the authors was found in the blood of one of the large richly coloured lizards found in Cayenne gardens. Its chief peculiarity was that it was found only within the leucocytes—the large and small mononuclears. The organism was enclosed within a very thin-walled cyst 9 to 11$\mu$ long by 5 to 7$\mu$ broad; it contained a nucleus of variable shape and a homogeneous protoplasm containing brightly staining chromatinic bodies disseminated throughout it. The haematozoon at first sight appeared oval but on closer examination was found to be 16 to 18$\mu$ long and folded back on itself, the tapering tail being bent back on the body.

Haemogregarines within the leucocytes of lizards have already been described by LAVERAN and others, but in those cases the majority of the parasites were found within the red corpuscles and other places. The authors propose the name *Haemogregarina weinbergi* for the parasite described by them.

BLANC (Georges). **Sur un cas de toxoplasmose canine observé en Tunisie.** [A Case of Canine Toxoplasmosis observed in Tunis.]—*Bull. Soc. Path. Exot.* 1917. May. Vol. 10. No. 5. pp. 377–378.

In this short note the author describes the first case of canine toxoplasmosis recorded in Tunis. The disease occurred in a dog that had been inoculated with crushed up material from the nymphae of ticks fed on a dog affected with kala azar. The dog died a month afterwards without in the meantime showing any symptoms, and on post-mortem examination toxoplasms were found in its organs but no Leishmania. Another dog treated in the same way became emaciated and developed conjunctivitis and opacity of both corneae, but no Leishmania or toxoplasms were discoverable on post-mortem examination. A fact of importance was that the dog affected with toxoplasms was kept in the same building as a number of gondi. Naturally occurring toxoplasmosis had been observed regularly for several years in autumn and in winter among these gondi, and the infection may possibly have been transmitted from them by means of larvae of ticks to the dog.

YAKIMOFF (W. L.). **Trichomonas de l'intestin de la sangsue du Turkestan (*Limnatis turkestanica.*).** [Trichomonas in the Intestine of the Turkestan Leech.]—*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 293–294.

Trichomonas have been observed in man and in several warm-blooded animals as well as in some cold-blooded animals. BRUMPT

found some of these organisms in leeches. In a smear from the intestinal contents of a species of leech found in the drains of Taschkente the author found the vegetative forms—oval, pear-shaped, and rounded in appearance. The dimensions of the organism, nucleus, and its three flagella are given. Certain peculiar bodies believed to be Trichomonas cysts were also seen.

NOELLER (W.). **Blut- und Insektenflagellatenzüchtung auf Platten.** [The Plate Cultivation of Blood and Insect Flagellates.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1917. Feb. & Mar. Vol. 21. Nos. 4 & 5. pp. 53–94. With 3 text figs. & 1 coloured plate comprising 6 figs.

The medium used by Nöller for plate cultures was a slight modification of the ordinary N.N.N. medium and was made up as follows:—Agar 10, glucose 10, slightly alkaline horseflesh broth 1,000. This is distributed in tubes each containing 12 to 18 c.c. and sterilised by placing in a steamer on two successive occasions. This medium is melted in boiling water and poured from the tube into small glass vessels and thoroughly mixed with an equal quantity of sterile defibrinated horse blood. The mixture is then quickly poured into a sterile Petri dish, the lower dish being about 9 to 10 cm. in diameter by at least 2 cm. in height. The dishes are then immediately placed in an ice chest for the medium to set.

When inoculated the Petri dishes are inverted in the ordinary way and to prevent contamination the condensation liquid is caught in a 2 to 3 per cent. solution of sublimate which forms a layer 1 to 2 mm. in thickness in the cover. At room temperature the sublimate is renewed every two to three days, and at a higher temperature (28° to 33° C) daily, to compensate for evaporation.

The plates are inoculated with a small platinum loop. Impure seed material is diluted in broth, a drop placed on the middle of the plate, and spread evenly over its surface by means of a glass bulb. Pure cultures are transplanted by means of a soft sterile moistened camel hair brush. For serological tests young thick cultures are used in which degeneration forms have not appeared and material is lifted up carefully by means of a platinum loop in order to avoid admixture with any of the culture medium.

Seed material for the cultivation of insect flagellates is obtained by first examining aseptically small pieces of the insect intestine in sterile salt solution under a low power of the microscope in order to determine the presence of flagellates. The small pieces are repeatedly washed in sterile broth to get rid of most of the contaminating bacteria. A single small piece is then placed in a drop of broth on a sterile glass slide and covered with a sterile cover glass, which is moved to and fro in order to distribute the flagellates. By means of a small sterile syringe containing 1 to 2 c.c. of broth one then places a drop of broth at one end of the cover glass and sucks up the liquid at the other end. The contents of the syringe are well mixed and the process repeated several times until most of the flagellates have been drawn up into the syringe. A drop of the mixture is then spread over a plate and the platinum loop used to inoculate two or three more plates successively.

In order to separate impure cultures of flagellates from bacteria one makes use of the fact that the flagellates usually cling together in

rosette-like clumps containing, as a rule, very small numbers of bacteria. The large cultivable flagellates also adhere very firmly to a glass slide. The material is thus placed in a large drop of sterile broth on a sterile glass slide and allowed to stand for 5 to 10 minutes. A small rosette-like clump then adheres so firmly to the slide that it can be washed with salt solution or broth several times without becoming detached. The clumps are then scraped off with a platinum loop and drawn up into a syringe containing about ½ c.c. sterile broth, shaken, and a drop used for inoculating one or several plates successively.

A second method used for the separation of flagellates, such as the sheep-louse Crithidia, which does not possess the same adhesive properties, consists in placing the impure culture in a drop of broth and carefully sucking up the large rosette-like clumps into a fine pipette. These are then mixed with another drop of broth, gently shaken, and again sucked up; the process is repeated until the clumps have been washed five to ten times.

*Leptomonas fasciculata* Novy, MacNeal, and Torrey, 1907.—This gnat Leptomonas, first described improperly by Léger, is important as it was the first insect flagellate cultivated (Novy and collaborators, 1906) on plates and on account of the ease with which it is cultivated. Pure cultures have been kept alive by Mesnil even on ordinary agar. The author himself cultivated the parasite from the hind gut of two Culex females according to the method above described. The plates were kept in the dark in an incubator at from 22° to 26° C. In three days small dew-like colonies ·25 to ·5 mm. in diameter could be seen between the numerous bacterial colonies. Two days later the colonies reached from 2 to 3 mm. in diameter, were rounded, flat, and transparent. Later these colonies spread over the plate forming a dense mass of flagellates of a greyish-white colour. If this material is now transplanted on fresh plates discrete colonies are visible in one or two days and in from 6 to 10 days the growth spreads over the plate as a thick film. In plates from one to three days old the parasites show distinct nuclei and round compact karyosomes in process of division. In older cultures the flagellates are thinner and show a very indistinct nucleus with a minute karyosome.

*Leptomonas ctenocephali* Fantham. (= *Leptomonas pseudoleishmania* Brumpt).—Flea leptomonads are of great interest inasmuch as they were recognised by Sangiorgi and Basile as stages in the development of the Mediterranean child Leishmania. The dog flea was thus supposed to transmit Leishmania from dog to man and from dog to dog. The author, however, in 1912, showed that this flagellate is very common in dog fleas in Leishmania-free districts (Berlin). Da Silva, in Morocco, obtained negative results in transmission experiments with fleas that had fed on infected children. Laveran and his collaborators and Fantham and Porter later claimed to have infected mammals with insect leptomonads; according to Nöller these writers failed to reproduce the pathological picture presented by a Leishmania infection and to demonstrate the viability of the Leishmania-like bodies said to have been found in the organs of the young animals supposed to have become infected.

Wenyon (1913) first obtained a pure Leptomonas culture from the human flea and the organisms cultivated presented a striking resemblance to Leishmania. Laveran and Franchini (1915) also obtained

pure cultures of leptomonads from the mouse flea (*Ctenopsylla musculi*).

Nöller successfully cultivated leptomonads from the dog flea in the condensation water of glucose-horse-blood-agar tubes in 1914. The tubes were kept at a temperature of from 18° to 21° C.; development was very slow; only after from six weeks to three months did the flagellates produce turbidity in the condensation water. The cultures, however, showed marked viability inasmuch as motile flagellates were observed in the sealed tubes nearly two years afterwards.

In plate cultures growth was very slow at from 23°–25° C., but at 29° C. just visible colonies were observed in from 11 to 12 days. Pure sub-cultures kept at 28° C. show in about 14 days small round colonies up to ·5 mm. in diameter, which later coalesce but show scarcely any tendency to spread beyond the inoculated area. The growth on plates is thus much slower than that of *Leishmania donovani*.

A number of mice were inoculated intravenously with ½ c.c. of a milky emulsion of Leptomonas culture. A few died during the following month with enlarged spleens due to infection with *B. coli*. Nine weeks after inoculation the remaining mice were killed and cultures were made from the spleen and liver, with entirely negative results.

*Leishmania donovani* Laveran and Mesnil, 1903.—The Hamburg strain of *L. donovani* sown on the author's plates showed on keeping in the dark at 22° to 25° C. after 16 days a 4 to 5 mm. broad greyish-white film along the inoculation mark. On sub-culture on plates growth was seen in 7 to 10 days spreading from 1 to 2 mm. beyond the line of inoculation and later (in about 35 days) short stumpy outgrowths 1 to 3 mm. long by 0·3 to 0·5 mm. broad could be observed. A loopful spread evenly over a plate shows a uniformly thick film in from two to three weeks. Growth is apparently better in tubes of glucose-horse-blood-agar than in N.N.N. horse-blood-agar.

*Crithidia melophagia* Flu, 1908. (=*Crithidia melophagi* Swingle).—The sheep louse Crithidia were first cultivated by Wenyon, 1912, in the condensation water of N.N.N. rabbit-blood-agar. The author himself succeeded in 1916 in cultivating these flagellates from the anterior portion of the mid-gut of a sheep louse on glucose-horse-blood-agar tubes. Growth took place very slowly and between the colonies there appeared minute colonies of a coccobacillus similar to *Rickettsia prowazeki* found in the clothes louse and believed to be the cause of typhus in man. The name *Rickettsia melophagi* is given to this small organism which is apparently always found in large numbers in the intestinal tract of the sheep louse. It shows bi-polar staining when stained with Giemsa. In mixed cultures of this small organism and the Crithidia growth takes place very slowly in both cases; at 23° to 25° C. the Crithidia developed rather more quickly than the Rickettsia, but at 28° to 29° C. the Rickettsia grew slightly more quickly than the Crithidia. Macroscopic clumps of the Crithidia were found in the condensation water after two months. These were separated by the pipette method described above and sown on to plates kept at 29° C.; in 21 days small flat round transparent colonies 1 to 1·5 mm. in diameter could be seen between the just visible protruding Rickettsia colonies. Pure cultures were subsequently obtained. The sheep louse Crithidia undoubtedly resemble those blood parasites

that are cultivated with difficulty. The best medium consists of glucose-horse-blood-agar in tubes.

The morphology of the organisms in culture is similar to that in the intestine of the sheep louse. The tendency to clump formation on the media is very apparent. The aspect of the very small culture forms and the difficulty with which they are cultivated precludes their identity with the cultural forms of the non-pathogenic cattle trypanosome *T. theileri*. If the theory of WOODCOCK and BEHN that the sheep louse Crithidia in England and Germany are stages in the development of sheep trypanosomes is correct then the latter organisms must differ from those of the *theileri* group. The author himself has had no opportunities of examining sheep trypanosomes.

*Trypanosoma theileri* Laveran, 1902.—The author demonstrated the identity of the flagellates cultivated from the gadfly *Tabanus glaucopis* and the ubiquitous cattle trypanosome in 1916 [see this *Bulletin*, Vol. 5, No. 1, p. 15].

The maintenance in the laboratory in a pure state of the forms then isolated led the author to devise his method of plate cultures. By this means pure cultures were obtained after five platings. The growth of the organism on plates is somewhat typical. In from five to seven days at 22° to 25° C. visible, rounded, dew-like transparent colonies ·5 mm. broad are seen. The colonies are later seen to throw out fine thread-like processes which again divide giving an appearance resembling that of a bark beetle. On moist plates the radiating processes grow two or more millimeters daily so that in a week's time, where there are numerous colonies, the plate seems covered with very fine threads. These threads are at first scarcely visible but later they become thicker, greyish-white in colour, and are clearly visible against the dark-red background.

During the first five to seven days long thin flagellated organisms are seen between which numerous dividing forms are found. The viability of the trypanosomes on plates is rather short. A few living forms were found in 47 day old plates kept at 22° C. Generally after from 7 to 10 days degeneration forms become very apparent, without flagella or undulating membranes and with numerous nuclei scattered throughout a single protoplasmic body.

*Trypanosoma syrnii* Mayer, 1911. (*Halteridium syrnii* Mayer, 1911).

The blood parasite from the wood screech owl, named as a Halteridium by its discoverer, grows easily in sub-cultures on plates. Stroke preparations kept at 22° to 25° C. show within seven days a number of parallel outgrowths 1 to 3 mm. broad and distant about 1 to 3 mm. from each other; these may attain a length of from 5 to 12 mm. and in 14 day old plates they may attain a length of up to 2·5 cm. The colonies are thus easily distinguishable macroscopically from those of the slowly growing cattle trypanosome from the gadfly. The colonies are of a greyish-white colour.

*Trypanosoma rotatorium* Mayer, 1843.—The commonly occurring and easily cultivable frog trypanosome was the object of a special study. The seed material was obtained from a well-nourished medium-sized water-frog showing a few rare trypanosomes in its blood. Blood was drawn from the abdominal vein and mixed with an equal quantity of citrate broth and sown on to plates kept at 22° to 25° C. In four days

minute colonies were seen which in seven days attained a diameter of 1 mm. In from two to three weeks they attained a diameter of 3 to 5 mm., but their margins remained regularly rounded. Stroke sub-cultures showed in 14 days a thick greyish-white film with smooth rounded borders spreading 3 to 5 mm. outside the inoculation track. On very moist plates short stumpy outgrowths from 2 to 3 mm. in length and which easily coalesce may be observed. During the first three weeks the culture shows slender, actively motile forms with homogeneous cytoplasm, but from that time onwards degeneration forms appear to a gradually increasing extent.

A number of experiments detailed by the author showed that it was possible to infect water frogs in most cases with large doses of culture. MENDELEEF-GOLDBERG, on the other hand, obtained only negative results in such experiments, frog serum being stated to be highly trypanolytic. Nöller, however, showed that it was possible to obtain multiplication forms in frogs that had already been infected, death resulting within a fortnight in some cases. The trypanosomes were then numerous in the heart blood and very rich preparations were obtained from the kidneys. Long whip-like trypanosomes and short striped ones as well as phagocyted Leishmania-like bodies could be seen. It is recalled that THIROUX showed that the common trypanosome of the Java sparrow might produce marked pathogenic effects when inoculated in large doses. The grass-frog was found to be more resistent to infection than the water-frog. Inoculation gave negative results in the case of toads and goldfishes although an abortive infection was demonstrated in some of the latter animals.

A number of serological tests were made by the author with the frog trypanosomes grown on plates. The emulsion for the agglutination test was made in the ordinary way by taking up some clean culture in a platinum loop and diluting it with salt solution. A number of trypanosomes were found to be still alive in this solution after three days even when diluted 350 times. Blood was obtained from the frog by severing the hind leg at the stifle joint. The frog could be used for further experiment by tying the skin back over the cut surface again. The agglutination tubes were read off first after two hours and next after from 18 to 24 hours. The tubes were kept at room temperature (17° to 21° C.).

The horse serum used for making culture medium showed distinct agglutination in 1 in 20, and appreciable up to 1 in 80 dilutions. Fresh unheated horse serum was found to be extremely toxic for the trypanosomes. All forms were dead within an hour in undiluted serum. A 1 in 10 dilution was also very toxic and after standing a day careful search revealed extremely few motile forms. Serum heated to 56° C. had lost its toxicity, but agglutination was still appreciable in dilutions of up to 1 in 80.

With fresh guinea-pig serum agglutination was obtained only in dilutions of 1 in 10 up to 1 in 20, but, on the other hand, its toxicity was greater than that of the sera of normal grass-frogs and infected water-frogs. The trypanosomes all became immotile in dilutions of up to 1 in 20, but with weaker dilutions—1 in 160—a few rare trypanosomes were seen alive and these were always the long forms with homogeneous protoplasm. Inactivation caused the toxicity to disappear but the agglutination titer remained as before.

These results are not in keeping with those of M.-GOLDBERG, whose technique, according to the author, was faulty, in that she used the trypanosomes suspended in the liquid of condensation of the medium. The author showed that even when mixed with the undiluted serum of an infected water-frog complete destruction of the trypanosomes did not take place. A few long forms remained. The same results were obtained with tadpole blood. The serum of infected water-frogs showed distinct agglutination in dilutions of 1 in 40 and appreciable in 1 in 80. Undiluted serum killed off nearly all trypanosomes, but about 1 per cent. remained alive; a dilution of 1 in 10 killed about 90 per cent.; a distinct toxicity could be seen in up to 1 in 40 dilutions. Inactivated serum was non-toxic.

The serum of non-infected grass-frogs showed complete agglutination in 1 in 40 and distinct 1 in 80. Undiluted serum killed off almost all trypanosomes but a few remained alive as in the case of the infected water-frog.

It is noted that although the serum of the infected water-frogs showed a certain trypanocidal action the infectivity of the animal need not be diminished; normal human serum shows a high trypanocidal action on the virulent *T. rhodesiense*. The problem of trypanosome infection is extremely complicated. Many trypanosomes are known not to multiply chiefly in the blood but in the lymphatic system and other organs. It is only the pathogenic African trypanosomes and the nearly related organisms that act as pure blood parasites. No specific immunity could be detected in chronically infected water-frogs.

*Schizotrypanum cruzi* Chagas.—It was not possible to obtain a direct culture on plates from a laboratory infected mouse but growth was easily obtained at 29° C. in the water of condensation of horse-blood-agar tubes. The organisms were seen as Leishmania-like bodies devoid of flagella among which extremely few flagellated forms were seen. Later crithidial forms were found at the periphery of the clumps. Sub-culture on to plates was made from the water of condensation and at 33° C. there was soon seen small rounded colonies which coalesced and covered the inoculation track with a thick film in 10 days. Growth was slower at lower temperatures, and it may thus be said to be moderately slow. On plates one finds Leishmania-like forms and also a large number of typical crithidial forms.

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## DISEASES DUE TO METAZOAN PARASITES.

COMMES (Ch.) & DEVANELLE (P.). **L'Onchocercose aortique bovine dans le Haut-Sénégal-Niger.** [Bovine Aortic Onchocerciasis in Upper Senegal and Nigeria.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 459–464. With 2 text figs.

In the course of a study of the human filariae of the above regions A. LEGER (1912) noted that filarial embryos were also widely distributed in the blood streams of other animals, such as the calf, dog, hyena, and a number of birds.

The authors maintain that the ox is the animal most often affected. In the course of examinations of the left bronchial glands of slaughtered cattle they often cut through glandular-looking bodies from the size of a pea to a cherry containing yellow, caseous, distinctly calcified material. These movable nodules were found to be attached by means of connective tissue to the external coat of the aorta. Swellings of a similar nature were also found in direct contact with the blood vessel or still completely embedded in its external coat. Similar lesions could also be found on incision in the thickness of the wall and some of these on section disclosed simply a sort of transparent coagulated lymph. On the internal surface of the vessel wall there were also to be found cysts of about the size of a lentil filled with greenish-yellow matter. One could also note sometimes under the endothelium wavy channels protruding into the lumen of the vessel and filled with a brownish-yellow transparent clot; sometimes they were deeper and showed up clearly as greyish tracks against the opal-like whiteness of the endothelial coat.

These lesions were found on the main aorta, on about the first 30 cm. of the posterior aorta, and the first 10 cm. of the anterior aorta. The curvature of the posterior aorta was always the part most extensively affected.

All these lesions contained a nematode worm; the worms must thus have burrowed through the walls of the arteries adjacent to the heart and finally invade the periarterial connective tissue. For some reason the worm becomes at times encysted at some period in the course of its migration. 151 animals out of 198 systematically examined for these lesions, or 76·3 per cent. were found affected.

The classification of the parasite was undertaken by Railliet who showed that it was identical with *Onchocerca armillata* Raill. and Henry, 1909. The parasite was first described by Lingard (1905) affecting the aortic wall of oxen and buffaloes in India, by Tuck (1907–1908) affecting oxen in the Malay States, and recognised by Railliet himself in 1902 in the aorta of a zebu from Sumatra. Bernard and Bauche (1912) also found it in Annamese cattle. It has already been found on the African Continent by Mason, who attributed the aneurisms frequently occurring in Egyptian cattle and buffaloes to this parasite. Certain variations in the nature and position of the lesions have been noted by various authors. Railliet states that in his original description of the parasite (1912) the disposition of the genital papillae at the caudal extremity of the male was not accurately described as a number of them escaped his attention. He now states that the number appears to vary considerably in parasites from different regions so that it is impossible to fix a definite papillary formula.

Delanoë (P.). **Au sujet de l'existence dans le Cercle des Doukkala (Maroc Occidental) de la sangsue de cheval,** *Limnatis nilotica* **Savigny.** [The Horse-Leech in Western Morocco.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 458–459.

The horse leech is frequently found to infect wells in the Doukkala district in Western Morocco, and cases of respiratory distress in the human subject are not infrequently caused by drinking water from these

wells. Horses are also very commonly affected in the same way. The author observed cases of pigs dead from asphyxia caused by this leech. The treatment employed by the natives consists in crushing up some onions together with tobacco and cautiously pouring the expressed liquid drop by drop into the nostrils and into the throat. This irritant mixture causes the animal to sneeze and cough violently and thus expel the leeches. The best way of ridding the wells of leeches is to breed eels in them.

MOUCHET (René). **Contribution à l'étude des Myiases.** [A Study of the Myiases.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 467–472. With 1 map.

In the country towards the western shores of Lake Tanganyika in the Belgian Congo the author studied a considerable number of cases of cutaneous myiasis affecting man and various animals. Nearly all the Europeans living in this region become infected with small cutaneous abscesses caused by a muscid larva. Under the name of " kiolo " this is well known to the natives as a parasite frequently infecting dogs. In one village situated at a fairly high altitude all the dogs were infected, small abscesses being found very commonly on the lower parts of their bodies.

On searching the native huts it was found that the rats and mice were almost constantly infected. Whereas, however, in the case of the dog a widespread infestation causes merely a transitory debility a fatal termination is often produced in the mouse and rat, or the abscess formation and gangrene may result, for example, in the loss of a limb. On the other hand, rats and mice caught outside in the open country among the brushwood showed no larvae and it thus appears that only those animals living inside houses become infected.

The parasite appears to be confined to the margins of the lake and can be found even in moderately high altitudes. The mouse and rat appear to be predilection hosts for the larva ; in one village it was noted that the larva disappeared after a number of imported cats had exterminated these rodents. The Katanga Scientific Commission (1910–1912) was of opinion that the fly does not lay its eggs directly on the hosts but in the places where they habitually repose. This may account for the relatively greater incidence of infection in the rat and mouse than in the dog, which spends the greater part of its time outside the hut. Europeans become more readily infected than natives, probably because the fly finds a suitable place for laying its eggs in the bedclothes of the former whereas the native generally sleeps on dry reeds or hard boards.

The adult larva measures from 14 to 18 mm. in length and shows the general characters of muscid larvae. Attempts at cultivating the young larvae proved fruitless but the transformation of the adult larva was easily obtainable. When deposited on dry earth it became a pupa in from 24 to 28 hours and in from 10 to 16 days afterwards the fly emerged. In six series of experiments thus performed five gave rise to flies of the species *Cordylobia anthropophaga* Bl. and in the other experiment the species was *Sarcophaga haemorrhoidalis* Meig. = *nurus* Rdi. These two species of flies are very abundant inside houses.

The authors maintain that the ox is the animal most often affected. In the course of examinations of the left bronchial glands of slaughtered cattle they often cut through glandular-looking bodies from the size of a pea to a cherry containing yellow, caseous, distinctly calcified material. These movable nodules were found to be attached by means of connective tissue to the external coat of the aorta. Swellings of a similar nature were also found in direct contact with the blood vessel or still completely embedded in its external coat. Similar lesions could also be found on incision in the thickness of the wall and some of these on section disclosed simply a sort of transparent coagulated lymph. On the internal surface of the vessel wall there were also to be found cysts of about the size of a lentil filled with greenish-yellow matter. One could also note sometimes under the endothelium wavy channels protruding into the lumen of the vessel and filled with a brownish-yellow transparent clot; sometimes they were deeper and showed up clearly as greyish tracks against the opal-like whiteness of the endothelial coat.

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A series of other muscid larvae have been found capable of causing myiasis in man and other animals in the Belgian Congo. The author himself studied in 1912 at Leopoldville on the head of an ox an extensive sore caused by the larvae of two species, viz., *Chrysomyia megacephala* Fabr., and *Lucilia sericata* Meig.

In 1914 at Tanganyika very serious ulcers involving the legs of goats were attributed to larvae of the species *Chrysomyia bezziana* Vill. = *megacephala* Fabr. Large oestrid larvae from 25 to 30 mm. in length are also frequently found in the nose and nasal sinuses of certain large antelopes, but breeding experiments with the larvae have given no results in these cases.

ROUBAUD (E.). **A propos de la communication de M. Mouchet "Contribution à l'Etude des Myiases."**—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 472–474.

In this criticism of the preceding article Roubaud states that the myiasis studied by MOUCHET was the ordinary African furunculous myiasis caused by *Cordylobia anthropophaga* Em. Blanchard. The larva was first discovered in Senegal in 1862 by COQUEREL and MONDIÈRE. The author has also shown that the larva of the fly described by DÖNITZ in 1905 under the name *Cordylobia murium*, which gave rise to a severe outbreak of disease among rats in German East Africa, was also identical with the above species. The natural infection of rats with this larva has been studied by DELANOË in the Ivory Coast. The larvae recently hatched out from the eggs may remain on the surface of the soil up to a fortnight at least awaiting the passage of a favourable host. The small larvae, which climb and are motile, then cling on to clothes and afterwards reach the skin. The eggs may also be hatched out directly on clothes, but infection cannot be produced directly in this way.

The second type of fly obtained by MOUCHET viz., *Sarcophaga nurus* Rdi., is not a specific causal agent of myiasis, but has a widespread distribution in various parts of the world. Infection by this larva must thus have been secondary to that of the first-named species.

Myiasis due to *Chrysomyia bezziana* Vill. is a specific myiasis of cattle in tropical Africa [see this *Bulletin*, Vol. 5, No. 1, p. 28].

ROUBAUD (E.). **Histoire d'un élevage de *Glossina morsitans* à l'Institut Pasteur de Paris.** [Breeding of *G. morsitans* at the Pasteur Institute, Paris.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 629–640. With 2 figs. & 3 tables.

The brood of flies described by Roubaud originated from one surviving fertile female *morsitans* and two males brought back by him at the end of 1913 from Senegal. The brood was kept alive in the laboratory for more than three years.

Breeding took place in an incubator with an average temperature of 25° to 27° C. and 50 to 55 per cent. average humidity. A vessel containing water placed in the incubator produced the necessary humidity. Continual change of air was found to be indispensable for normal development. At one period the incubator temperature accidentally exceeded 32° C. and caused a mortality of 50 per cent.

among the pupae and the adults. LLOYD in Rhodesia observed that at 30° C. 49 per cent. of the pupae did not undergo further development. In the Nigerian Soudan the author bred *morsitans* at a temperature of 32° C., but this represented the average daily temperature established according to the maxima and minima.

Cages made of a metallic framework, 14 cm. by 8 cm. by 4·5 cm., covered with muslin of 1 mm. mesh served for breeding; 15 to 20 flies could be kept in one such cage. The flies were fed by applying the cage against the shaved abdomen of an animal. The larvae deposited in the cage made towards a corner to become transformed into pupae.

It was again demonstrated by the author that Glossina can be nourished on nothing else but blood. They could also be fed on citrated blood through a piece of chamois leather. The males and fertilised females during the laying period fed daily; the females, however, refused to bite the day before hatching a larva. Females not fertilised or not laying fed much less frequently, at intervals varying from one to seven days. The flies fed equally well on fowls as on guinea-pigs and rabbits. Although the incubator-bred flies appear to withstand the artificial conditions quite well and even attain in some cases a remarkable longevity the brood remained limited to about 20 flies per month. This is due to the short life and small productivity of the females and to the relatively large number of sterile pupae.

About two-thirds of the females did not live more than two months. Two flies showed an unusual longevity in that they lived for over five months. STUHLMANN, in the case of *G. brevipalpis*, observed a maximum lifetime of 3½ months. BOUET in Dahomey noted a maximum of four months for *G. palpalis*; KLEINE and FISCHER observed a similar duration (143 days).

Over a third of the pupae produced did not undergo further development. The large mortality among pupae bred artificially is most probably due to the bad conditions of deposition, the larvae often failing to find suitable places to become transformed into pupae.

Copulation takes place without any difficulty in the cages a few hours after the birth of the females. Larvae are hatched on an average from 15 to 20 days after copulation and pupae follow each other very regularly every 9 to 11 days. The majority of the larvae are laid between 5 and 6 p.m. In the Nigerian Soudan the author had noted that the *morsitans* laid every eight to nine days at 32° C. average daily temperature. KINGHORN in Rhodesia noted a great irregularity in the deposition of larvae of the same species and gives an interval of 14 to 15 days as normal for successive layings in laboratory conditions.

The majority of flies did not produce altogether more than five pupae each. Two, however, gave birth to 12 and one, in the course of a lifetime of 5½ months, produced the large number of 14 pupae. Some females were affected with sterility due to some unknown cause. The end of the brood was marked by considerable diminution in laying on the part of the females. The sterile females were found to have normal ripe eggs in the ovaries but these did not, however, descend into the uterus.

Changes of host for feeding purposes did not lead to more frequent laying. After the last laying the flies usually fed very irregularly.

The author never found the larvae of *G. morsitans* to produce a fluid secretion as described by LAMBORN and other observers.

The duration of pupation was on an average 30 days; the period was always longer for males than for the females. In the Nigerian Soudan the period was found to be from 23 to 28 days on account of the high average temperature (32° C.). LLOYD gives 21 to 25 days at 30° C., while KINGHORN noted a much longer period, 47 to 53 days, at laboratory temperature. NEWSTEAD gives 24–26 days as the duration of pupation in *morsitans* in Nyasaland.

With regard to the relative number of the sexes the author was able to confirm the views of other observers that the two sexes are equally numerous in artificially bred Glossina. The end of the brood was, however, marked by a characteristic preponderance in the number of males (out of 16 adult flies there were 15 males and 1 female, which did not survive). This sudden disappearance of females could not be accounted for and was the principal cause of the failure to carry on the breeding.

The author failed to infect his flies with *T. rhodesiense* and *T. brucei*, Uganda strain. Experiments were made in connection with the infection of pupae by means of a Chalcid parasite of muscids. The chalcid was found to lay its eggs in the pupa of *G. morsitans* as easily as in those of Calliphorina, the genus usually invaded. However, the individuals which develop inside the *morsitans* pupa cannot penetrate its thick covering and become liberated when they arrive at the adult stage. All the pupae bitten were killed, but none of the parasites emerged as they all died in the interior of the pupae. This experiment thus shows that it is impossible to employ these parasites for the destruction of *morsitans* pupae as proposed by AUSTEN.

YAKIMOFF (W. L.). **Les tiques des animaux domestiques du Turkestan russe.** [Ticks of the Domesticated Animals in Russian Turkestan.] —*Bull. Soc. Path. Exot.* 1917. Apr. Vol. 10. No. 4. pp. 298–301.

In the first part of this article a list of the various species of ticks identified by the author himself on domesticated animals in Russian Turkestan is given. The article is supplemented by tables showing the distribution of ticks in Russia, and for purposes of reference one of these tables is reproduced as follows:—

"*I.—List of genera and species of ticks found in Russia.*

"IXODINI.

"*Ixodaria.*

"Genus: *Ixodes* Latreille.

"*Ixodes arcticus* Herb. Osborn.—The Poibylevy Islands (according to NUTTALL).

"*I. arenicola* Eichw.—Borders of the Caspian Sea and Podolia (doubtful species; according to NEUMANN, probably *Hyalomma aegyptium*).

"*I. berlesei* Birula.—Borders of Angara (according to NEUMANN the description and figures are insufficient for identification).

"*I. cornuger* Kol.—Caucasus (doubtful species; according to NEUMANN, probably *Hyalomma syriacum*).

"*I. andyptidis* var. *singnatus* Birula. — Ungalaschka (Aleontian Islands).

"*I. hirsutus* Birula.—Ungalaschka, Eastern Siberia

"*I. reduvis* L.—Caucasus, government of Kieff, Kursk, Nijni-Novgorod, Riassan and north-west, and Finland.
"*I. spinocoxalis* Neumann.—Caucasus.
"*I. trianguliceps* Birula.—Borders of Lake Onega (doubtful species; according to NEUMANN, probably *I. tenuirostris*).

"*Rhipicephaloria.*

"Genus: *Rhipicephalus* C. L. Koch.
"*Rhipicephalus bursa* Can. and Franz.—Caucasus.
"*Rh. rossicus* Yakimoff and Kohl-Yakimoff.—Government of Saratow.
"*Rh. sanguineus* Latr.—Caucasus.
"*Rh. simus* Koch.—Turkestan.
"Genus: *Margaropus* Karsch.
"*Margaropus annulatus calcaratus* Birula.—Caucasus, Turkestan.
"Genus: *Hyalomma* C. L. Koch.
"*Hyalomma aegyptium* L.—Government of Astrachan, Kherson and Tschernomorsk, Caucasus, Siberia, Turkestan.
"*Hyalomma syriacum* Koch.—Caucasus Turkestan.

"*Amblyommataria.*

"Genus: *Aponomma* Neumann.
"*Aponomma crassipes* Neum.—Steppes of Kirghises (?)
"Genus: *Dermacentor* C. L. Koch.
"*Dermacentor reticulatus* Fabr.—Government of Kursk, Mohilev, Riasan, Saratow and Kherson, oblastes Primorsk, Caucasus, Siberia, borders of Amur, Turkestan.
"*Dermacentor variegatus* var. *kamschadalus*.—Kamchatka.
"Genus: *Haemaphysalis* C. L. Koch.
"*Haemaphysalis ambigua* Neum.—Caucasus (?)
"*H. concina concina* Koch.—Poland.
"*H. concina kochi* Neum.—Amur.
"*H. flava* Neum.—Caucasus.
"*H. leporis* Pack.—Caucasus.
"*H. neumanni* Dönitz.—Government of Primorsk.
"*H. papuana* Thorell.—Caucasus.
"*H. punctata* Can. and Franz.—Government of Kherson, Caucasus.

"ARGATINI.

"Genus: *Argas* Latreille.
"*Argas persicus* F.-W.—Government of Saratow, Caucasus, and Turkestan.
"*A. reflexus* Fabr.—Town of Odessa.
"Genus: *Ornithodoros* Koch.
"*Ornithodoros canestrini* Birula.—Caucasus.
"*O. tholozani* Lab. and Megn.—Caucasus.
"*O. talayae* Guér.—Borders of the Aral Lake."

SWEET (Georgina) & SEDDON (H. R.). **The Viability of *Melophagus ovinus* Linn., the Sheep Louse-Fly, Sheep Ked, or Sheep-"Tick."** —*Vet. Jl. (with Australian Supplement)*. 1917. Apr. Vol. 73. No. 4. pp. 6–14. With 3 tables.

The only work recorded on this subject appears to consist of the rather crude experiments of CURTIS and SWINGLE. Both these authors found that the "tick" died off within four days when taken off the sheep. SWEET and SEDDON performed a number of small experiments with lots of 20 ticks each taken from unshorn sheep in November (Australian summer, weather wet and mild). In these experiments all the "ticks" were found dead, when kept in the conditions enumerated, within the following time limits:—moist grass in cellar $6\frac{3}{4}$ days; moist grass on lawn $5\frac{3}{4}$ days; dead leaves on soil on lawn $2\frac{3}{4}$ days;

dead leaves on soil in cellar 11¾ days; bare soil on lawn 2¾ days; bare soil in cellar 11 days; wool in laboratory 3¾ days; wool in cellar 4 days.

The authors draw up the following provisional conclusions:—

"A moderately cool uniform temperature is the most favourable condition for the persistence of the 'tick' off the sheep and without food, especially if it be dry.

"If extremes of temperature be present then moisture is necessary, dryness soon proving fatal.

"The life of 'ticks' in shed wool is short under uniform temperatures, whether cool or moderate.

"The state of nutrition does not seem to have influenced the viability of these 'ticks.'"

ADERS (W. M.). **Insects Injurious to Man and Stock in Zanzibar.**—*Bull. Entom. Res.* 1917. May. Vol. 7. Pt. 4. pp. 391–401.

Over a half of this paper is devoted to an enumeration and description of the gnats and mosquitoes of Zanzibar and Pemba Islands; seven species are described as occurring in Zanzibar town while 39 species were identified altogether on the islands.

Tabanidae are found in abundance in wooded areas close to streams and marshes in various districts in both islands. A few species were captured in open arid or grassy country. Their prevalence varies with the seasons and they are very abundant for about six weeks after the rains. Ideal weather conditions are slight showers of rain with intervals of sunshine. During heavy rain or high wind they may appear to be altogether absent. These flies have not been definitely proved to play a part in the spread of disease in Zanzibar but there is a certain amount of evidence that they are capable of acting as carriers of *T. pecorum*, the common trypanosome of stock in the island. Repeated efforts have been made to prove this experimentally but owing to the extreme difficulty of keeping these flies alive in captivity and inducing them to bite experimental animals, no positive results have yet been obtained. Seventeen species were altogether identified. The commonest tabanid is *Tabanus taeniola* P. de B. which often attacks man; when alighting on cattle it nearly always selects the lumbar region, seldom the legs, and becomes engorged in about 2½ to 3 minutes; in mixed herds of cattle and domesticated buffaloes the latter are always singled out for attack as they seem more callous to the bites. The small species, *T. par* Walk. has a wide distribution throughout the two islands; it nearly always feeds on the withers and hocks of cattle. *T. gratus* Lw. was observed in large numbers in various districts of both islands. *T. biguttatus* Wied., another common species, generally feeds on the hump of cattle seldom attacking any other part; engorgement in some cases takes 4½ minutes; males were taken on tree trunks in proximity to grazing grounds. *Aegophagomyia pungens* Aust. is a common species along the littoral of both islands and appears to be very little affected by high wind; on several occasions it was noticed feeding on goats. *Haematopota decora* Walk., the only species of this genus found, is very prevalent throughout the whole year and generally feeds on the hocks and withers of cattle, engorgement taking place in about 2½ minutes; this insect lives moderately well in captivity and has been used on many occasions in captivity experiments.

*Chrysops longicornis* Macq. is very common on both islands throughout the whole year; as many as 30 were captured in a few minutes on one donkey; its withers and hocks were smothered with them; once they have started feeding nothing disturbs them and they must be almost brushed off.

Muscidae.—The distribution of ten species is given. *Stomoxys calcitrans* L., occurs everywhere in the island where cattle are found. "Larvae have been found in recent moist droppings; manure pits swarm at all times of the year with larvae and pupae. Animals somewhat out of condition are especially singled out for attack, and this is a useful diagnostic sign when looking over a herd for a suspected trypanosome case. The following non-biting Muscids have been noticed feeding in association with *S. calcitrans*, licking the droplets of blood left from the Stomoxys puncture:—*Musca domestica*, *Pycnosoma putorium*, and *Biomyia tempestatum*."

Oestridae. "*Oestrus ovis* L. Large numbers of larvae have been taken from the frontal sinuses of goats; in some cases they had penetrated to the base of the horn, but they do not seem to cause any appreciable damage to their hosts. The pupal stage averages 19 days. Very common throughout the island. *Gastrophilus asininus* Br.—A few adults have been taken flying around cattle and donkeys."

One species of Drosophilidae and five of Hippoboscidae were identified. The number of Hippoboscids taken was surprisingly few and the author believes that a moist damp climate like that of Zanzibar is inimical to their development. *Hippobosca maculata* Leach, is common in cattle, horses, and donkeys; *Lynchia maura* Bigot., is common on domesticated pigeons.

Of fleas and lice, *Ctenocephalus canis* Curtis is found on dogs and large numbers have been taken from goats; *C. felis* Bouché, from goats; *Dermatophilus penetrans* L. is common and has been taken on two occasions from dogs; *Echidnophaga gallinacea* Westw., is very common on fowls especially on the bare parts of the head and around the eyes, while several specimens have also been taken from the common town rats. *Haematopinus tuberculatus* N. is common on domesticated buffaloes; *Liognathus vituli* L. was found on calves.

The following is a list of the ticks identified:—

"*Rhipicephalus appendiculatus*, Neum. The commonest species on cattle; undoubtedly the carrier of African coast fever.

"*Rhipicephalus simus*, Koch. Taken on cattle and donkeys.

"*Rhipicephalus sanguineus*, Latr. Very common on dogs.

"*Rhipicephalus evertsi*, Neum. Common on cattle, goats and sheep. Generally found around the anus or in the ears.

"*Rhipicephalus pulchellus*, Gerst. A rare form in Zanzibar. Numbers can be found on cattle imported from the Somali Coast, including replete females. This tick, probably owing to climatic conditions, has been unable to acclimatise itself on the Island; no specimens have been obtained from local stock.

"*Rhipicephalus maculatus*, Neum. From domesticated pig.

"*Boophilus decoloratus*, Koch. Abundant on cattle.

"*Boophilus australis*, Fuller. From local cattle.

"*Amblyomma variegatum*, F. Taken from cattle, goats, sheep and camels.

"*Amblyomma hebraeum*, Koch. A rare species; a few have been obtained from cattle.

"*Hyalomma aegyptium*, L. A number have been collected from camels; on other domesticated animals they seem to be rare. I am inclined to

think that this species, like *R. pulchellus*, has been unable to acclimatise itself.

" *Haemaphysalis leachi*, Aud. Very common on dogs.

" *Haemaphysalis bispinosa*, Warb. From imported Indian cows."

BODKIN (G. E.) & CLEARE (L. D., Jnr.). **Notes on some Animal Parasites in British Guiana.**—*Bull. Entom. Res.* 1916. Oct. Vol. 7. Pt. 2. pp. 179–190. With 1 map & 3 text figs.

The following are among the more important of the species identified by the authors as affecting the domesticated animals:

" Nematoda.—*Filaria cervina*, Duj. A single specimen of this parasite was obtained from the abdominal cavity of a cow at the Georgetown Abattoir. It does not appear to be a common species.

" *Filaria immitis*, Leidy. It would probably be a difficult matter to find a creole dog over two years in age which does not harbour this parasite. Dogs about two years old generally possess at least one adult worm in the heart itself or in the pulmonary artery. In old dogs a thick tangled mass of the worms is often found in these organs, which would appear to choke them completely. However, the presence of this parasite seems to have but little effect on the general well-being of the dog. Imported dogs seem to thrive and are not rapidly killed by this worm as has been reported from China. The mosquito, *Culex fatigans*, Weid., is the probable vector of the disease.

" *Ascaris megalocephala*, Cloquet. One specimen of this large worm was obtained from a horse after the administration of a purgative.

" *Ankylostoma* sp. A common species, resembling *A. ceylanicum*, Loos, in the intestine of most dogs. As many as 15 of these worms have been taken from one dog.

" *Physaloptera ? praeputialis*, Linst. An exceedingly common parasite in the stomach of most cats. From 4 to 12 of these worms are usually found firmly attached to the stomach wall. Lutz has recorded the occurrence of this parasite in Brazil in the same host.

" Platyhelminthes.—*Dicorcelium* sp., near *D. lanceatum*, Stiles & Hassall. This parasite seems to be extremely prevalent among cats in the colony. At times the liver will be found to be very heavily infested, while in other cases only a few flukes will be found.

" Cestoda.—*Moniezia expansa*, Rud. This species was taken from a pig at the Georgetown Abattoir. It is not normally a parasite of the pig, but it is possible that in some manner or other the worm as excreted from its original host may have been consumed by this animal, as pigs are notorious eaters of all kinds of refuse and filth

" Acanthocephala.—*Echinorynchus gigas*, Goeze. This appears to be a common inhabitant of the small intestine of pigs in British Guiana; numerous specimens have, on various occasions, been obtained from pigs slaughtered at the Georgetown Abattoir.

" Acarina. Ixodidae.—In British Guiana all kinds of live-stock are attacked by various species of ticks, which are in many cases directly responsible for a very considerable annual financial loss. Preventive measures, such as dipping, are quite unheard of and the presence of these pests is universally regarded with the utmost indifference.

" *Argas persicus*, Wald. This tick is a common inhabitant of fowl-houses throughout the Colony, and the larvae are to be found on most varieties of poultry. The larval stage of this tick is known locally as 'Nimbles.'

" *Rhipicephalus sanguineus*, Latr. One of the commonest external parasites of dogs. All stages of development may be found on this animal. Between the digits and within the ears are favourite points of attachment.

" *Margaropus annulatus* var. *australis*, Fuller. Flourishes on all kinds of cattle. Steers that have been in the pastures for a few months soon become heavily infested and thereby lose weight and condition. Instances have been observed where several ticks have attached themselves to the eyelids and engorging there caused intense irritation. The death of a cal

through tick infestation is not uncommon. The institution of properly constructed dipping or spraying contrivances would handsomely repay the initial outlay. This tick has a number of other hosts, including the common toad or "Crapaud" (*Bufo marinus*).

"Diptera. Tabanidae.—Within the coastal region the Tabanidae are of common occurrence, though they are chiefly composed of large numbers of a few common species. Within the forest areas, however, these coast-land species seldom appear and their place is taken by numerous other species, some of which are comparatively rare. According to information received, the savannah lands near the Brazilian border are particularly rich in Tabanidae, but up to the present no opportunity has occurred for collecting or making definite observations within this area.

"The common species of Tabanidae that attack live-stock on the coast-lands belong to the genus *Tabanus*—*T. trilineatus*, Latr., *T. senior*, Wlk., and *T. semisordidus*, Wlk.; of these *T. trilineatus* is possibly the commonest and most widely distributed.

"The numerous muddy trenches and ditches that are necessary for drainage purposes all over the coastal area, and more especially in the cultivated portions such as the sugar estates, provide very suitable breeding places for these flies, but very little is known of their life-histories; a wide and fascinating field for research is thus presented.

"A recent outbreak of Mal de Caderas (*Trypanosoma equinum*) amongst the sugar plantation mules was in all probability propagated by biting flies, and most of the common species of Tabanidae and other biting flies, such as the well-known *Stomoxys calcitrans*, L., were observed to feed freely on mules afflicted by this deadly equine disease.

"The principal enemies of Tabanidae are several species of the large predaceous wasps belonging to the Bembecinae. These, owing to their characteristic yellow and black coloration and fierce habits, have received the peculiar Creole name of 'Cowfly tiger.'

"Wherever Tabanidae occur, large numbers of these wasps will be observed to be active, especially round cattle and mules when in the pastures. Despite the loud buzzing flight and active darting movements of their enemies, the Tabanidae seldom display any concern at their presence, though they take good care to choose those portions of their host least exposed to the manoeuvres of the wasps. They are always more numerous on sandy soils, which provide greater facilities for their nesting habits. . . .

"Muscidae.—*Stomoxys calcitrans*, L. In all parts of the coastal area and in many of the inhabited areas of the inland regions this fly is of common occurrence. About stables in Georgetown, and particularly about the mule stables and compounds on the sugar estates, numbers of these flies are continually active, more especially in the early morning and evening hours. In the absence of other food supplies it will readily attack human beings and often proves most irritating. No decided increase in its numbers has been observed at any special season of the year.

"Hippoboscidae. A number of these flies are known to infest different kinds of birds and some mammals, but their activity, and the manner in which they quickly leave their host at its death, renders their capture extremely difficult.

"*Lynchia maura*, Bigot. Frequently found on domestic pigeons.

"Sarcopsyllidae.—*Dermatophilus penetrans*, L. This well-known species is widely distributed over the Colony. They are known locally as 'Jiggers' or 'Chigoes.'

"Pulicidae.—*Ctenocephalus felis*, Bouché. Probably the commonest species on the coast-lands. It is the common flea of domestic cats and dogs and occasionally attacks man.

"Haematopinidae.—*Haematopinus eurysternus*, Nitzsch. Collected from cattle on the coast-lands. It is the common cattle louse.

"*Haematopinus tuberculatus*, Nitzsch. This species was collected from imported Indian buffaloes, which apparently are the only hosts in British Guiana.

"*Haematopinus suis*, L. Very common on pigs. It was collected several times on these animals at the Georgetown Abattoir.

"Mallophaga. This order is well represented in British Guiana. From the economic standpoint the presence of ill-kept and overcrowded fowl-houses and pigeon-lofts and pens of a like character for sheep and goats accounts largely for the abundance of these parasites and for their wide distribution among domestic animals.

"Some species of birds in the wild state appear to be heavily infested with lice, while others again are almost entirely exempt.

"*Trichodectes pilosus*, Gieb. On donkey (*Equus asinus*).

"*Trichodectes climax*, N. On goat (*Capra hircus*).

"*Trichodectes sphaerocephalum*, N. On sheep (*Ovis aries*)."

Various species of other families of Mallophaga affecting several kinds of birds and the guinea-pig are then given.

## EPIZOOTIC LYMPHANGITIS.

CHATELAIN (P.). **Considérations générales sur le traitement de la lymphangite épizootique.**—*Rev. Gén. Méd. Vét.* 1917. July 15. Vol. 26. No. 307. pp. 289–293.

In this preliminary note the author first discusses some of the characteristics presented by the disease according to his observations in Morocco. In order that the disease may assume an acute form two factors are necessary: (1) a warm country, (2) a damp climate. In Morocco the disease occurs in a particularly serious form along the coast, whereas in elevated districts at some distance away it is less severe and often becomes cured spontaneously. Flies abound in the hot, humid districts throughout the year and, after a case of epizootic lymphangitis has been observed, it is not rare to find the disease appearing after 20 to 60 days in horses bearing harness wounds and not brought into contact with the affected animals.

Potassium iodide gave no good results in the author's hands but caused the animals treated to become extremely restive. Biniodide of mercury gave only partial success. "606" likewise failed to give the expected results. Treatment by means of iodine and methylene blue employed after dilaceration of the tissues in early or localised cases gave excellent results. In the elevated districts this treatment cured all the affected animals. 350 cases were treated at a hot and damp centre near the coast with 86·2 per cent. recoveries in from 30 to 40 days, 11·1 per cent. in from 40 to 110 days, while 2 per cent. were slaughtered on account of generalisation. 85 per cent. of these cases were brought in from districts along the coast and 15 per cent. from elevated districts. The same treatment employed at Casablanca failed to give the same results; VELU, who tried other treatments especially with novarsenobenzol, in the same conditions, failed to get the expected results.

In France the iodine-methylene blue treatment was applied in the Somme region and gave good results. The author claims that typical epizootic lymphangitis can be distinguished clinically in that the hair becomes shed at a spot and then a bud develops raising the skin, which becomes brilliant in appearance. A bud resembles a black grape with the dust wiped off and bursts spontaneously two or three days afterwards discharging a yellowish, granular pus from a crater-like ulcer with raised and thickened borders. In the so-called ulcerative lymphangitis the buds are generally situated on a limb, often

causing lameness. They are developed underneath the skin and are only revealed on palpation. The hair does not fall from their surface. After two or three days the abscess spontaneously bursts discharging a yellowish, sticky, often sanguinolent pus; the abscess becomes rapidly closed if treated with antiseptics but almost immediately it has cicatrised a new abscess develops a short distance away. The animal is lame when the buds form in the neighbourhood of a joint.

The author records a couple of cases of ulcerative lymphangitis successfully treated by means of the iodine-methylene blue method.

The author thus recommends that every horse not reacting to mallein and showing a number of multiple abscesses developing in echelon on a limb should receive two injections of 10 cc. of 1% methylene blue intra-muscularly at three days' interval. A cure is obtained in a few days without any local treatment except washing with weak antiseptic solutions such as tincture of iodine.

TRUCHE & GUIGNARD. **Contribution à l'étude de la lymphangite épizootique.**—*Bull. Soc. Cent. Méd. Vét.* 1917. Jan. 4. *Rec. Méd. Vét.* 1917. Jan. 30–Feb. 28. Vol. 92. Nos. 3 & 4. pp. 64–68.

In this short article the authors describe a series of eleven observations on the treatment of epizootic lymphangitis occurring in horses which had been cast from the French army in France. Various products recommended by French authors were tried, viz., luargol, potassium iodide, novarsenobenzol, and galyl. The use of galyl by DOUVILLE in the treatment of this disease has already been referred to in this *Bulletin* [Vol. 4, No. 3, pp. 111]; out of five cases treated exclusively with this drug four recovered completely and one showed considerable progress. The cryptococcus was demonstrated in each case. The authors' conclusions are as follows:—

Epizootic lymphangitis is amenable to treatment by means of galyl.

Small doses, even frequently repeated, and large doses given at too long intervals did not give appreciable results; it is preferable to inject at once at least three grammes on the first two occasions at intervals of a week. The tolerance of animals for this product being very great there is no harm in giving frequent doses.

If a cure is not obtained after the first two injections one may recommence the treatment with 2 or 3 grammes without any danger.

PERRIN. **Notes sur la détermination de la période d'incubation de la lymphangite épizootique en France.** [Length of the Incubation Period of Epizootic Lymphangitis in France.]—*Bull. Soc. Cent. Méd. Vét.* 1917. May 3. *Rec. Méd. Vét.* 1917. Apr. 30–May 30. Vol. 92. Nos. 9 & 10. pp. 191–194.

In a unit comprised of artillery horses in France the author had under his observation five cases which at different times contracted injuries affecting various parts of the body. These injuries healed after a few days but subsequent to healing swollen lymphatics were found to originate from the seats of the former injuries; the lesions thus set up were found to be due to epizootic lymphangitis. The length of time these lesions of epizootic lymphangitis took to develop after the healing of the wound would represent the minimum period of incubation, while the length of time from the infliction of the injury would correspond with the maximum period. For the five horses the

maximum periods were thus, respectively, 127 days, with possible error below 15 days; 111 days, error below 24 days; 115 days, error below 15 days; 120 days, error below 7 days; 120 days, error below 15 days. This gives 118 days as the average maximum incubation period, which would be 15 days in excess of the minimum.

CHARMOY. **Sur la lymphangite épizootique.**—*Rec. Méd. Vét.* 1917. Apr. 15–May 15. Vol. 93. Nos. 7 & 8. pp. 179–196. With 5 figs. & 1 table.

The greater part of this paper is devoted to the symptomatology and lesions of the above disease, chiefly as they occur in army horses at the front in France. The disease is stated to be a common affection in certain of the French colonies (Algeria, Morocco and Senegal), but, before the war, it was almost unknown in France. It made its appearance among horses at the front towards the end of the year 1914 and from being rare and localised at that date it has now become so common and widespread that it constitutes a veritable danger for the cavalry.

The author had under his own observation a few interesting cases of generalisation and of lesions on the more rarely affected parts. Cases are thus depicted affecting the skin above and below the lips and closely resembling horse-pox lesions, lesions on the pituitary mucous membrane, and around the vulva. In one case on post-mortem a specific ulcer was found on the internal surface of the cricoid cartilage of the larynx. In two cases lesions of chronic endocarditis were found on the mitral valve of the left heart in the form of fibrous nodules about the size of peas, together with patches of endarteritis; these lesions, however, were not specific but in the nature of complications. No lesions were discovered in the lungs although in many cases purulent centres were discoverable in the pulmonary parenchyma, but these never revealed the presence of cryptococci.

With regard to treatment the author's experience has led him to adopt the surgical method wherever practicable. Various drugs recommended by different authors were tried but gave inconstant results. The ideal local treatment is stated to consist in the extirpation of all the affected parts and in the case of small lesions this method gives perfect results. When it was not possible to employ this radical method of treatment he attempted to sterilise the purulent centres by cauterisation, by the application of chemical agents, or by a combination of these two methods. In every such case the horse is cast and securely bound, a heated sharp-pointed cautery is then introduced into each abscess or into the opening of each ulcer; every protruding lymphatic is explored in the same way and it is then always found to reveal pus in its depth. The borders and depth of these lesions are well cauterised and the point of the instrument pushed as far forwards as possible within the interior of the lymphatic vessel. Excessive granulations are excised by means of the flat cautery.

With the aid of the ordinary cautery, or better by means of the auto-cautery, the author next inserts a series of fine points about 1 cm. from each other all round the affected part. This circle is circumscribed by a double or triple circle of punctures in order to prevent extension. A blister is then applied all over the cauterised surface. There is no risk attached to this no matter how extensive the surface treated. On the following few days there is an enormous reaction, then

towards the 6th day or 7th day the reaction diminishes. The affected part is then treated by the application of antiseptics such as saturated alcoholic picric acid or methylene blue. If fresh abscesses appear they are punctured by means of the pointed cautery. The author gives in a table a list of 48 animals treated as above; 29 were cured after a period varying from 20 days to 3 months, 8 were destroyed on account of the severity of the lesions and of the remaining 11 all, with the exception of 1, were gradually progressing towards recovery.

BRINGARD. **Un traitement de la lymphangite épizootique.**—*Bull. Soc. Cent. Méd. Vét.* 1917. June 7. *Rec. Méd. Vét.* 1917. June 30. Vol. 92. No. 12. pp. 216–224.

In this article the author describes a method of treatment adopted by him with successful results over thirty years ago in Algeria. His observations led him to conclude that the appropriate treatment consisted in the surgical extirpation of the swollen lymphatic vessel or its destruction by means of some procedure acting directly on the interior of its lumen. The drugs employed failed to give satisfactory results. The removal of the lymphatics by means of a bistoury is attended with grave risks on account of the damage done to the surrounding tissues, and of secondary infection.

The instruments thus used by the author consisted of iron rods about 18 inches long and about the thickness of a lead pencil provided with a wooden handle at one end. These rods heated white hot served to cauterise the whole of the interior of the lymphatic. The operation is easily performed; the horse is cast so as to expose the affected lymphatics. If the lymphatic is no more than about 9 inches long one excises the bud on the side away from the lymphatic gland and then inserts the heated rod into the exposed orifice and passes it along the interior of the channel up towards the centre of the lymphatic gland. When the affected lymphatic is longer the process is repeated two or three times by passing the rod each time from a distal bud to another situated more centrally. The rods may be curved in order to follow tortuous lymphatics. Cases where the buds are not connected by means of apparent lymphatics are inoperable by this method, but such cases are very rare, and do not exceed 5 per cent. During the first week after the operation an abundant suppuration takes place leading to the shedding of the cord and glandular congestion.

A 10 per cent. solution of tincture of iodine is afterwards injected into the channel. It is claimed that cures can be affected in four to five weeks in cases of horses refractory to all other methods of treatment.

Details are given of eight cases occurring in the French army; on these the author had the opportunity of again testing his method of treatment. The results again proved its efficacy as all the horses were cured in a comparatively short time.

FINZI (Guido). **Les composés du mercure dans le traitement de la lymphangite épizootique.** [Treatment of Epizootic Lymphangitis by means of Mercurial Compounds.]—*Bull. Soc. Path. Exot.* 1917. June. Vol. 10. No. 6. pp. 428–430.

Five seriously affected cases were successfully treated by the injection at short intervals of the following mercurial compounds:—6 per cent.

salicylate or 5 per cent. calomel in liquid paraffin intramuscularly, 1 per cent. perchloride or benzoate combined with cacodylic acid in watery solution, subcutaneously or intramuscularly. From ten to twelve injections of doses varying from 5 to 40 c.c. repeated in each case every two or three days were required to produce complete recovery.

FAVERO (F.). **L'arsenivan nella cura del farcino criptococcico.** [Treatment of Epizootic Lymphangitis by means of Arsenivan.] —*Moderno Zooiatro. Parte Sci.* 1917. June 30. Vol. 6. No. 6. pp. 129–136.

In this short article the author gives a review of the literature dealing with the treatment of epizootic lymphangitis and records observations of ten cases of the disease occurring in Italy. These were treated by means of an Italian arsenical preparation—arsenivan—prepared at Parma University. Cures were obtained in all cases in from 11 to 30 days. The drug was well tolerated when administered by the digestive tract or intravenously, but produced moderately severe reactions when injected subcutaneously.

VELU. **Le traitement curatif de la lymphangite épizootique par la vaccinothérapie.** [Vaccine Treatment of Epizootic Lymphangitis.]—*Bull. Soc. Cent. Méd. Vét.* 1917. May 3. *Rec. Méd. Vét.* 1917. Apr. 30–May 30. Vol. 92. Nos. 9 & 10. pp. 195–204.

The vaccine is made up as follows:—Pus withdrawn aseptically is emulsified with 10 times its bulk of normal saline solution to which is added 0·25 per cent. carbolic acid and about 0·14 per cent. ether. The mixture is then filtered through several thicknesses of sterile open-wove gauze.

Subcutaneous inoculation of a suitable dose of this mixture sets up quickly a reaction manifested by very distinct clinical symptoms. A negative phase is first observed in which all the symptoms become aggravated—suppuration increases, the larger buds ripen and sometimes open, the affected lymphatics become more swollen and tender. This phase lasts three or four days, sometimes five or six. Its intensity varies with the dose of vaccine employed.

This phase then changes rather quickly—in 24 or 48 hours. The swelling around the lymphatics diminishes and buds appear which were not visible before the injection. Healing of ulcers is accelerated; secretions from open abscesses and large sores diminish to such an extent that local treatment is almost unnecessary. This positive phase lasts on an average from four to five days but it may vary from no time up to ten days; the disease then resumes its normal course. A repeated injection causes the same cycle of phenomena to appear but if it is performed before the end of the positive phase the negative phase following is somewhat delayed and it is less intense and does not last so long as in the case of the first injection.

The problem in the treatment of epizootic lymphangitis by means of vaccine therapy thus resolves itself into the determination of suitable doses and the intervals after which they should be renewed in order to set up mild negative phases and well marked positive phases. Velu, who has had very considerable experience with the disease in

Morocco, gives a record of eight seriously affected cases in which this treatment was carefully carried out. He considers that the record justifies the expectation of good results. The vaccines failed in each case where the affected animal was so weak in condition that it was unable to react. "A cure is thus not assured in every case but a great advance is made on the treatment of the disease by means of drugs and on the local treatment consisting in the application of antiseptics or excision of the lesions." Recovery was produced in the cases described within six weeks.

As the result of his experience Velu recommends the injection of $2\frac{1}{2}$ c.c. of the vaccine and then allowing an interval of seven or eight days to elapse. If there is persistent aggravation of the symptoms the dose injected was too strong and a few days should elapse before injecting a smaller dose. If there is no change the dose injected was too weak, and a larger dose should be injected immediately. If there is distinct progress the dose is sufficient and should be renewed or slightly increased or decreased, according to the reaction which one desires to set up. A cure can be obtained in this way after 30 to 40 days.

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## BACTERIAL DISEASES.

TRUCHE (C.). **Traitement bactériothérapique de la lymphangite ulcéreuse.** [Vaccine Treatment of Ulcerative Lymphangitis.]—*Ann. Inst. Pasteur.* 1917. May. Vol. 31. No. 5. pp. 209–214.

The above disease has apparently assumed a very serious character among army horses in France; the author claims to have obtained distinctly satisfactory results in treatment by the use of dead cultures of the organism isolated from the lesions, viz., the Preisz-Nocard bacillus.

M. NICOLLE, LOISEAU and FORGEOT observed a very high specific antitoxic power in the serum of infected animals. This was equal to or even higher than that of horses immunised by CARRÉ by means of filtrate. These authors, however, showed that the serum of affected animals was devoid of anti-bacterial properties.

Cultures were obtained by growing the organism, maintained in the laboratory on solid serum, on potato agar in Roux flasks incubated for 24 hours at 37° C. The bacterial growth is twice washed by emulsifying in salt solution and centrifugation. The bacteria are then killed by adding equal quantities of alcohol and ether and allowing to stand for 24 hours. The overlying liquid is then poured off and the bacteria dried at 37° C. The vaccine is prepared for use by emulsifying the powder in normal salt solution, 1 centigramme per 1 c.c., and distributing in ampoules which are heated to 100° C. for four or five minutes.

The dose of vaccine is 1 centigramme inoculated every week under the skin of the neck. A small swelling forms at the seat of inoculation. "One may see the buds shrink, suppuration dry up, and the cords disappear after the second injection, but recovery usually takes place after the third." A number of figures are given showing the results

of this treatment. In one lot, out of 43 animals treated, after the third injection 14 were completely cured, 23 were in various stages of recovery, while the remainder died from various causes or were killed on account of debility.

[This mode of treatment is not new. Dead cultures were used by MONTGOMERY in British East Africa for the treatment of a cutaneous disease of equines from which the Preisz-Nocard bacillus was isolated (see this *Bulletin*, Vol. 5, No. 1, pp. 64).

We cannot see the force of using the alcohol-ether mixture " in order to eliminate the life (that is to say, the virulence) of the germs without changing their antigenic qualities, etc.," if before injection they are heated to 100° C. for five minutes, and still maintain the desired properties.—ED.]

TRAWIŃSKI (Alfred). **Ueber das Vorkommen von Bakterien der Typhus-Coligruppe im Darminhalt gesunder Schweine, zugleich ein Beitrag zur Differenzierung der Bakterien der engen Paratyphus B.-Gruppe.** [Bacteria of the Typho-Coli Group in the Intestinal Contents of Healthy Pigs; Differentiation of the Bacteria of the Small Paratyphoid B. Group.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1917. Jan. 10. Vol. 83. No. 1. pp. 117–176. With 24 tables & 6 text figs.

The question as to whether bacteria of the paratyphoid B. group can be found in the intestines of healthy pigs has already been investigated by several authors (DORSET, UHLENHUTH, and others). The material used by the author for ascertaining the presence of these bacteria was obtained from the contents of the jejeunum, colon, and caecum of apparently healthy pigs which had been brought in for slaughter to the abattoirs from places free from disease and kept under observation for about 10 days before slaughter. The suspected colonies obtained on sowing out this material underwent a long series of searching laboratory examinations.

The author's conclusions are as follows :—

(1) From the intestinal contents of 500 healthy slaughtered pigs were grown 26 strains (5·2 per cent.) which from the appearance of the colonies, biological characters, agglutination tests, and partly according to their pathogenicity fell into three groups.

(a) Two strains belonged to the small paratyphoid B. group and were identical with *B. suipestifer* from the appearance of the colonies and partly also from the results of agglutination tests and pathogenicity towards white mice.

(b) Eight strains which formed a uniform type of colony differed in their biological characters from representatives of the small paratyphoid B. group only in so far as that they did not ferment sorbite ; serologically they showed an affinity towards *B. aertryk* (de Nobele) and partly also towards *B. suipestifer*. 62.5 per cent. of these strains were pathogenic for white mice. They formed indol and should be classed with the paratyphoid-like strains.

(c) Sixteen strains possessed a common type of colony and differed biologically from representatives of the small paratyphoid B. group in that they did not ferment dulcite and sorbite. They were agglutinable with the anti-sera of representatives of the small paratyphoid B. group. Their own anti-serum agglutinates the strains of this group very highly but has no influence on representatives of the small paratyphoid B. group ; the strains of the second group were partly agglutinated and partly not influenced. In all the strains a positive indol reaction was obtained ; 12·5 per cent. were pathogenic for white mice. They were recognised as pseudo-paratyphoid strains.

(The strains belonging to the second and third group could not be placed in the system of classification of the typho-coli group according to Weber and Haendel or Gildemeister and Baerthlein, for they did not completely correspond culturally with *B. paratyphosus* B.)

(2) The representatives of the small paratyphoid B. group (*B. paratyphoid* B., *B. aertryk* de Nobele, *B. suipestifer*, *B. typhomurium*, and *B. psittacosis* Nocard) cannot be sharply distinguished from each other by means of their morphological, biological, and serological (agglutination, Castellani's test) properties, nor according to their pathogenicity, but that differentiation is possible is shown by the results obtained from examining the types of colonies.

HARDENBERGH (J. B.) & BOERNER (Fred Jr.). **Vaccinations against Hemorrhagic Septicemia, No. 2.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Series. Vol. 3.) No. 7. pp. 868–876. With 2 tables.

In a previous report the authors published an account of work carried out by them for the Pennsylvania State Live Stock Sanitary Board for the year 1915. Vaccination during that period was carried out by means of living 48 hour broth cultures of *Bacillus bovisepticus* isolated from outbreaks of haemorrhagic septicaemia. No special measures were taken to attenuate the organism as experience had shown that no method of attenuation was capable of producing strains that would furnish uniform results. The only test to which the inoculation material thus complied was that it should be virulent for rabbits and guinea-pigs but not for sheep and calves. The use of living vaccines would ordinarily appear to give far better results than the use of killed or modified vaccines as the latter most probably lose their antigenic properties to a considerable extent. One of the drawbacks in connection with the use of living vaccines, however, lies in the fact that centres of infection may be established, but the experience gained in 1915 showed that no fresh cases occurred during the following year among the vaccinated herds.

Vaccination was carried out in the same manner during the year 1916 in a total of 31 herds. The first 11 vaccinated herds, termed "exposed" herds, contained steers that had passed through public stockyards, become infected, and been taken to the farms and mixed up with the native cattle. These herds contained altogether 265 animals; six deaths occurred prior to vaccination, and 24 animals were sick at the time of vaccination. With the exception of one sick animal all were vaccinated; only one death afterwards occurred in the herds.

The remainder consisted of native herds in the mountainous districts of Pennsylvania in which the disease appeared during the months of June to October; there were 53 deaths before vaccination and 19 sick at the time of vaccination. Twenty deaths occurred following the treatment.

During the two years 1915 and 1916, 25 native sick animals at pasture were vaccinated and of these 13 succumbed to the disease. In 1916, 22 out of 23 sick vaccinated steers recovered; these were suffering from the chronic pulmonary form of the disease and had been exposed to infection in stock yards. This chronic form of the disease is seldom seen on pasture, the acute form being observed instead. The authors conclude that the vaccine may have some therapeutic value in chronic cases.

The complete absence of haemorrhagic septicaemia in 1916 in the herds vaccinated in 1915 might indicate that considerable immunity had been conferred on the animals; however, the absence of the disease also from a number of control herds left unvaccinated and kept under observation during 1916 invalidates such a deduction.

The authors propose to carry on further experiments in this connection.

MOHLER (J. R.). **American Veterinary Medical Association. Report of Committee on Diseases.**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Series. Vol. 3.) No. 7. pp. 895–904.

The information regarding the following three diseases is extracted from the above report.

*Haemorrhagic septicaemia.* (Stock-yard fever, shipping fever, contagious pneumonia).—An unusually large number of cases of this disease occurred during the autumn of 1915 and spring of 1916. The disease appeared among cattle in public stock markets or in shipments that had been recently handled through public stock yards and it was believed that the infection was picked up in the stock yards or from the trucks in which the animals were transported. Frequently native cattle became infected within a week after coming in contact with other animals that had contracted the disease from stock-yard exposure. In some instances native cattle appeared to become infected after the recent admission of cattle from stock-yards, although no visible symptoms of the disease could be detected in the latter animals. Examination of the lesions showed that the disease was caused by *Bacillus bovisepticus*. In several instances infected cattle transmitted the disease to sheep upon the farms into which they were brought and in one instance a colt which was running with diseased sheep became infected. The disease has been recognised in the United States for the past 20 years; a few outbreaks have occurred every year, but the losses were unusually large during the past year and the application of quarantine measures is contemplated in some States in order to prevent further outbreaks. All cattle are susceptible but young animals are more susceptible than adults. Cows in which the vitality has been lowered by heavy milking and exposure by standing in yards during cold and stormy weather proved very susceptible. The most serious outbreaks occurred among store cattle in poor condition, especially if kept in a crowded shed for some time prior to sale. Examination of carcases at abattoirs often showed lesions of haemorrhagic septicaemia in cattle which were kept for 7 to 10 days in pens prior to being sold, whereas no lesions could be found in cattle slaughtered within three or four days after entering the yards.

The loss from the disease ranges from 2 to 20 per cent. of the herd although the mortality among affected animals is from 70 to 90 per cent. The mortality is not alarming in view of the large number of cattle that pass through the public stock-yards of the country, although in several instances losses from death were reported amounting to 50 per cent. of a herd. Vaccination by means of so-called "bacterins or dead bacterial products has been adopted but as the outbreaks in untreated herds usually terminate abruptly with losses varying from

2 to 20 per cent. the value of the preventive treatment is not definitely known." . . .

"*Dourine.* Dourine in horses has increased somewhat in prevalence in certain states during the past year. This condition is due to the spread of the disease among the horse stock of the Indian reservations and to the inability of the Bureau of Animal Industry to prosecute vigorously the work of inspection and eradication at the round-up season because of lack of funds. Of 45,100 samples of blood serum tested by complement fixation by the Bureau during the fiscal year ending June 30, 1916, 1,400 gave positive reactions. This is 3·1 per cent, as compared with 2·7 per cent for the preceding fiscal year. The infected states are Montana, Wyoming, North Dakota, South Dakota, Nebraska, and Arizona. Notwithstanding the difficulties, good results have been accomplished in the work of eradication.

"*Swamp Fever* [Infectious Anaemia of Equines]. That swamp fever is of increasing economic importance is evidenced by the fact that it has gained a foothold in New York, where it was not recognised prior to 1914. That the diagnosis should have been confused with 'other septicemic diseases,' suggests that there may be still other localities where swamp fever may be present without having been recognised. Within the last 10 days this disease has been reported from Louisiana where it was causing considerable losses on at least one plantation.

"Unfortunately continued experiments in sero-diagnosis have thus far failed to yield a satisfactory diagnostic procedure. Likewise experiments in insect transmission of this infection have been entirely negative. A recent experiment has shown that an animal in good condition and without showing any outward appearance which would arouse suspicion, may retain the virus of swamp fever in the blood even after 6 years. The blood of this animal when inoculated into another horse produced swamp fever in 13 days. The former animal therefore furnished a source of infection for insects during 6 years, but during this time no spontaneous cases developed, even though healthy horses were kept in the same stable without protection against insects. During this time both *Tabanus* and *Stomoxys* flies have been present, as well as many other species of insects."

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## DISEASES DUE TO FILTERABLE VIRUSES.

MORI (Nello). **Rabbia e Setticemia emorragica in alcuni bufalotti.** [Rabies and Haemorrhagic Septicaemia in some Young Buffaloes.] —*Ann. Staz. Sperim. per le Malat. Infet. d. Best.* Naples. 1915. Vol. 3. No. 1. pp. 55–80.

A disease showing symptoms affecting almost exclusively the nervous system had caused the death of four young sucking buffaloes on a farm where there was no history of a previous occurrence of such a disease. About a month previously two dogs had presented clinical signs of rabies in this neighbourhood and had been destroyed. The heads of two of the calves were sent to the author for examination. No histological changes were seen in the brain.

In one case sub-dural inoculation of rabbits produced slight symptoms of intoxication immediately afterwards from which they recovered but died of paralytic symptoms about a fortnight afterwards. Inoculations by passage of brain material from these rabbits definitely demonstrated the presence of rabies virus in the brain.

In the case of the second calf inoculation of brain substance subdurally into rabbits produced violent symptoms of intoxication

affecting the nervous system immediately after inoculation from which the animals died within five hours. No organism was cultivable from the blood or any of the viscera of the rabbits. These symptoms were also produced by the inoculation of the filtrate obtained by passing an emulsion of brain substance through a Berkefeld filter.

The brain of the first calf kept on an ice chest for three days, then emulsified and passed through a Berkefeld filter was also capable of setting up similar symptoms but to a far less degree.

Microscopic and cultural examination of the brains of both the young buffaloes revealed the presence of small numbers of a Pasteurella organism identical in appearance and cultural characters with *B. bubalisepticus*, the cause of "barbone," or buffalo plague. Inoculation and feeding experiments showed that the organism isolated manufactured in liquid cultures a very powerful toxin capable of setting up marked nervous symptoms in rabbits, guinea-pigs, dogs, and young buffaloes.

These experiments appear to show that the symptoms shown by the naturally affected calves, although resembling those of furious rabies in bovines, were not attributable to the rabies virus since they could be reproduced experimentally by the inoculation of a toxin contained in the brain of buffaloes, rabbits, or set up by means of a culture of the organism isolated from the brain. By its association with the rabies virus in milk-fed young buffaloes *B. bubalisepticus* appears to have undergone a great increase in virulence. The dams were more resistent as all contract "barbone" while young and this seems to confer a lifelong immunity.

REMLINGER (P.). **La rage spasmodique du cobaye.** [Spasmodic Rabies in the Guinea-Pig.]—*C. R. Soc. Biol.* 1917. June 16. Vol. 80. No. 12. pp. 590–592.

When the guinea-pig is inoculated with rabies virus into the anterior chamber of the eye it shows a special form of rabies which is interesting on account of the analogy of the symptoms with those produced in human rabies. Whether the eye remains intact or becomes shrunk up, as is very often the case even when the inoculation is carefully carried out, the disease commences with an intense local reaction in every way comparable with the reaction produced in the scars of bites in human beings. This reaction is manifested both by objective and subjective symptoms. Lachrymation occurs, the conjunctiva becomes congested and suppurates, the eyelids become red and swollen, and the lesions become the seat of an intense pruritus; the animal scratches them furiously with its paw or rubs its head on the same side as the inoculated eye against the walls of its cage. Almost at the same time the animal attracts attention by a sort of sonorous, coarse, thick gurgling noise comparable to the croaking guttural of certain frogs. It can be easily seen that this particular noise takes place in the pharynx and is connected with difficulty in swallowing set up by a spasm of this organ. The pharyngeal spasm appears to correspond exactly with the hydrophobic spasm in human rabies.

At the same time the animal presents a dejected appearance, erect hair, and dyspnoea. It remains motionless in its cage and if forced to move its gait betrays a certain degree of paresis.

Its condition soon becomes aggravated and violent convulsive crises are produced. These commence with the above described guttural noise; then instead of remaining localised the pharyngeal spasm becomes generalised throughout the body. The animal then bends itself round on the ground and emits feeble plaintive cries. After a few seconds it gets up on its feet and remains still until further convulsions are produced. A moderate sensory stimulus such as contact with water, sharp noise, sudden tapping, touching of the inoculated eye, etc., bring about instantaneously the reappearance of these symptoms. These crises finally become almost continuous until the animal is unable to get up and respiration gradually ceases. The total duration of visible disease rarely exceeds 48 hours, and is never longer than three or four days.

The author proposes to designate this particular form of rabies under the name of "spasmodic rabies."

REMLINGER (P.). **Le virus rabique dans ses passages de cobaye à cobaye.** [Changes Undergone by the Rabies Virus in the Course of Transmission from Guinea-Pig to Guinea-Pig.]—*C. R. Soc. Biol.* 1917. June 30. Vol. 80. No. 13. pp. 628–630.

The rabies virus attains its maximum virulence more quickly in guinea-pigs than in rabbits; after a small number of passages—seven or eight—one obtains a virus capable of producing rabies symptoms after five or six days and which, when inoculated into the dog, exceeds in virulence the natural disease in that animal.

The symptomatology of rabies in the guinea-pig is liable to vary according to a number of factors, the chief of which are the seat of inoculation, age of the animal, nature and dose of virus. Other things being equal the first intracranial passages, starting from the dog's medulla, set up most often the paralytic form of rabies.

After a very small number of passages (one to four) it is on the contrary the furious form which is seen in its most exalted form. The guinea-pig stands with hairs erect, blows hard, has a fiery look, runs about its cage biting the other occupants, passes its head through the grating at the risk of choking itself, "chuckling," scattering its food about, etc. Soon the animal becomes still more agitated, shows great genital excitement, falls on its side, then gets up, and goes on again but soon it tires itself out and assumes a staggering gait. Finally, it remains stretched out affected with intense dyspnoea, gives a few sudden jerks with its limbs and body, but these become gradually weaker, while respiratory movements gradually cease. Death then very soon supervenes.

If the inoculation is made in the anterior chamber of the eye the "spasmodic rabies" is produced characterised by an intense reaction both objective (congestion, lachrymation) and subjective (pruritus) at the point of inoculation, pharyngeal gurglings, and spasms and more or less violent convulsive crises. . . .

However, from the seventh to the fifteenth passage the acuteness of the symptoms becomes lessened and the course of the disease can no longer be termed furious. There is no restlessness and the chief symptom is dyspnoea, the symptomatology closely resembling that of the numerous pulmonary affections which very often occur in

guinea-pigs. At other times even dyspnoea is very slight and the guinea-pig is found in the morning dejected and lying still in a corner of its cage with erect hair, no appetite, and regardless of its surroundings. In the evening it lies on its side, tossing its body and limbs, and soon succumbs; the symptoms are more analogous to those of a septicaemia than of a broncho-pneumonia.

At the same time the length of the incubation period and of the visible disease is so shortened that death occurs very regularly from the fifth to the seventh day. Sometimes even it is produced so rapidly during the night of the fifth or sixth day or during the course of the fifth day that it appears to have taken place suddenly, as there was no time to observe any marked symptom. These are the so-called fulminating forms of rabies; no lesion is shown in the organs, cultures from the blood and viscera remain sterile, and a positive result is only obtained by passages. In the course of experiments with rabies every guinea-pig which dies without characteristic symptoms, or is found dead with no symptom, should be held as suspicious. Negri bodies should be looked for and the medulla inoculated.

From about the twelfth to the twenty-fifth passage paralytic phenomena become superimposed on the above symptoms. In the course of the later passages they assume an increasing importance and then no matter how many times the virus is transmitted from guinea-pig to guinea-pig it is from the exclusively paralytic forms that the animals succumb. While the rabies following inoculation into the muscles of a limb commences generally with a paralysis involving contraction of the inoculated limb (tetanic type) the paralytic rabies observed as the result of passages through the brain and anterior chamber of the eye is of the flaccid type. This takes place nearly always on the sixth day, rarely on the fifth, and exceptionally on the seventh. Paralytic phenomena appear to be produced sooner when the original virus is obtained from a dog dead of paralytic rabies than of furious rabies. Large doses of virus and inoculation of young animals also predispose towards the paralytic forms.

SANI (Luigo). **Sul passaggio del virus rabido attraverso la mucosa oculo-congiuntivale sana e traumatizzata.** [The Passage of Rabies Virus through the Healthy and Injured Oculo-Conjunctival Mucous Membrane.]—*Ann. d'Igiene.* 1917. Jan. 31. Vol. 27. No. 1. pp. 16–22.

The author's experiments, which were performed with fixed viruses for the rabbit and for the guinea-pig, showed that it was possible to reproduce rabies experimentally by passage of the virus through the oculo-conjunctival mucous membrane only when the virus had a markedly exalted virulence for the species of animal selected for experiment; the disease could in such cases be set up whether the mucous membrane was macroscopically healthy or contained recent artificially produced lesions. Cases of rabies are, however, rare even after instillation of an emulsion of an exalted virus into the conjunctival sac.

The instillation of virus that had not been exalted did not produce rabies. The author believes like former writers that the rarity of the cases thus produced is due not to a neutralisation of the virus in situ

but to the abundant lachrymation immediately produced after the instillation.

According to his experiments the lesions present on the mucous membrane are of secondary importance in the production of experimental rabies. One must thus admit from these experiments that in the case of injury of the mucous membrane the minute quantities of virus that pass through become neutralised along the course of the ramifications of the nerve fibres.

FERMI (Claudio). **Il nuovo metodo italiano per la cura antirabbica.** [The New Italian Method of Anti-Rabic Treatment.]—*Ann. d'Igiene.* 1916. Vol. 26. Supplement. 164 pp.

The method of rabies vaccination evolved by Fermi at Sassari, Sardinia, is briefly as follows.

The vaccine consists of a 5 per cent. emulsion of a potent fixed virus, carbolised 1 per cent., direct from the rabbit or dog. The brain instead of the cord is used as the former was shown to be more active. The anti-rabic serum is obtained by hyperimmunising horses, using the above vaccine as antigen. The sero-vaccine consists of 1 part of serum and 2 of vaccine, carbolised 1 per cent. The method of treatment consists in the administration of sero-vaccine for the first 5 to 10 days followed by the injection of the vaccine alone up to the 25th day. The mortality from rabies following this treatment was calculated to be lower than that following treatment according to the methods employed by HÖGYES, BERNSTEIN, and REMLINGER. Advantages claimed for the vaccine and sero-vaccine are that they can be preserved for long periods sterile and potent in sealed tubes, can be transported over any distance for use, do not inconvenience the patient, and set up an immunity immediately in the case of severely bitten patients.

The new Italian method is stated to have been substituted in British India for a number of years for the Pasteur and Högyes methods on account of the superior results obtained.

MARTOGLIO (F.). **Sui corpuscoli speciali osservati da Braddon nel sangue di animali infetti di peste bovina e ritenuti probabilmente specifici.** [The Peculiar Bodies observed by Braddon in the Blood of Animals infected with Rinderpest and claimed to be Probably Specific.]—*Ann. d'Igiene.* 1917. Apr. 30. Vol. 27. No. 4. pp. 246–250.

In 1913 BRADDON published a paper in which he maintained that by the addition of a solution containing 1 per cent. potassium citrate and 0·5 per cent. methylene blue in different proportions to rinderpest-infected blood peculiar slender bodies of varying shapes could be always demonstrated within the red corpuscles [see this *Bulletin*, Vol. 2, No. 1, pp. 45–47]. Martoglio had at his disposal a number of bovines affected with rinderpest at the Serum Institute at Eritrea and experiments were carried out using the technique recommended by BRADDON in order to ascertain whether the above bodies could be detected.

It was found that out of 30 bovines affected with rinderpest, blood taken three days after the onset of fever or six days after infection

presented none of the forms claimed to have been rendered visible by BRADDON in all cases of the disease under the form of granules and filaments in the interior of the red corpuscles and with sharp or rounded extremities, etc. It thus seemed that BRADDON's bodies had no connection with the rinderpest virus. The filamentous forms which he observed in fresh preparations did not appear to represent a morphological stage of the virus since they were revealed in the blood of healthy bovines afterwards shown to be perfectly susceptible and also in the blood of an animal not receptive, and in a horse. The author believes that the bodies represent degenerative changes in the corpuscles brought about by the treatment to which they are subjected.

GINS (H. A.). **Ueber experimentelle Vaccine und Vaccineimmunität.** [Experimental Vaccinia and Vaccinia Immunity].—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Aug. 18. Vol. 82. No. 1. pp. 89–142. With 2 tables.

This paper is an account of work, undertaken by order of the German Minister of the Interior, on the question of cow-pox immunity and a full discussion of the work already done on the subject is included. The animals used for the experiments were exclusively rabbits, as these animals were found to be most convenient and furnished the best results. In all 173 rabbits were inoculated with virulent material, for the most part by scarification of the cornea and some also by scarification of the skin.

The following are the author's conclusions :—

"The spontaneous appearance of vaccine pustules was never observed in rabbits and therefore the single pustules which always result could be dealt with experimentally.

"Rabbits inoculated with virulent material over a large skin surface always showed swelling of the precrural lymphatic glands and almost always enlargement of the spleen.

"Experiments performed in order to bring about multiplication of the vaccine virus on the ordinary artificial media always ended in failure.

"An infected cornea, cultivated in plasma according to the Harrison-Carrel method preserved the virus remarkably well. The newly formed tissue in the plasma showed cell inclusions which were not distinguishable from vaccinia corpuscles.

"Bacteriological tests of a considerable number of glycerinated lymphs never revealed the presence of pathogenic bacteria. The number of organisms diminishes so rapidly by preserving in glycerin that only a very few single germs gain access to the scarification marks in the vaccination of children.

"The cornea of the rabbit does not hold a special position of its own with regard to vaccine immunity. The cornea takes part in the general immunity to a slight degree whether the rabbit is inoculated into the skin or whether the rabbit is immunised by intravenous injection. A marked infection of the cornea can lead to immunity throughout the whole body.

"The immunity of the cornea follows considerably later than that of the skin after cutaneous or intravenous inoculation.

"Vaccine immunity in the rabbit is not a pure histogenic immunity as van Prowazek regarded it. The blood stream must be regarded as carrier of the immune bodies.

"The anti-virulent substances described by earlier workers are specific reaction products following on vaccine infection. They appear so regularly and abundantly and are durable for so long a period after infection that they must be held to demonstrate an acquired active immunity."

Gins (H. A.) & Weber (R.). **Ueber den Nachweis des in die Blutbahn eingespritzten Vaccinevirus in inneren Organen bei Kaninchen.** [The Fate of Cow-Pox Virus injected into the Blood Stream in the Internal Organs of the Rabbit.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1916. Aug. 18. Vol. 82. No. 1. pp. 143–154. With 2 tables.

Conclusions :—" With regard to the presumed fate of the vaccine virus injected intravenously the following conclusions are laid down as the result of our experiments :—

" The fact that the virus disappears very quickly from the blood stream was also confirmed in all our tests.

" By means of the test of Calmette and Guerin the virus can be demonstrated in the skin in very small quantities and by no means constantly." (This test consists in injecting a rabbit intravenously with virus ; if the skin is shaved at any time up to 24 hours after injection pustules appear on the shaved area.)

" This virus owes its survival apparently to the fact that it gained access into the blood vessels of the skin immediately after inoculation and thereby escaped rapid destruction in the animal body.

" After intravenous injection of large quantities of virus the virus can be demonstrated in the spleen in varying large quantities if this organ is used for inoculation within the first five hours after the injection.

" The virus was never demonstrable in the bone marrow ; and, in the liver it was found once only in small quantities after the injection of 50 c.c. of lymph diluted 20 times and once in considerable quantity in an animal after excision of the spleen.

" The spleen of rabbits inoculated into the skin was found to contain virus in only one case."

Martel (H.). **Rapport sur les opérations du Service Vétérinaire Sanitaire de Paris et du Département de la Seine pendant l'Année 1915.** pp. 146. 1916. Paris: Grande Imprimerie " Le Papier." [Myocardite aphteuse. (Myocarditis and Foot-and-Mouth Disease.)] p. 146.

" In the course of outbreaks of foot-and-mouth disease cases of sudden death observed among cattle are generally attributed to an acute form of the disease affecting the nervous system. Examination of a carcase in 1915, during the January outbreak, shows that death may occur otherwise.

" A cow in good condition was slaughtered. There were pronounced foot-and-mouth disease lesions in the process of healing on the tongue, ulcers of the same nature around and between the claws of the hind legs, and complicated ulcers due to infection with soiled litter.

" The infection of the sores on the hind legs manifested itself by a marked reticular lymphangitis of the fetlocks and by an inflammation of the lymphatic vessels extending upwards to the external iliac glands, which were swollen and haemorrhagic. The heart, which was not enlarged, presented an abnormal colour showing an irregularly marbled appearance due to light interposed areas. On incision the heart wall was found to be the seat of an intense myocarditis. Several soft haemorrhagic centres were distributed throughout the tissue in such a way that the myocardium might become perforated at any moment, with fatal results."

Cosco (Giuseppe) & Aguzzi (Angelo). **Sulla virulenza del sangue dei bovini aftosi e prove d'immunizzazione contro l'afta epizootica.** [The Virulence of the Blood of Bovines affected with Foot-and-Mouth Disease and Experiments on Immunisation against this Disease.]—*Direzione Generale della Sanità Pubblica.* 12 pp. 1917. Roma : Stabilimento tipografico Innocenzo Artero.

This pamphlet is issued by the Italian Public Health Administration

by whose direction a series of experiments are being conducted by various workers under the control of a special Commission.

In a previous note Cosco and Aguzzi referred briefly to the results of their experiments which demonstrated in particular the virulence of the blood during the febrile period in foot-and-mouth disease [see this *Bulletin*, Vol. 4, No. 2, pp. 62].

After natural or artificial infection a rise of temperature follows after a period of incubation varying with the mode of infection and virulence of the infective material. If highly virulent material from fresh lesions is rubbed on to the scarified buccal mucous membrane the incubation period may be limited to 24 hours or even less; ordinarily it is from two to five days. After subcutaneous inoculation with highly virulent red corpuscles (2nd or 3rd passage) the incubation period lasts about 70 hours, but never less, while with corpuscles of lesser virulence it lasts on an average from five to nine days; inoculation with virulent blood serum gives practically the same results.

The fever is of the remittent type and is preceded for about an hour by other symptoms, such as rigors and loss of appetite. The rise in temperature then reaches about 2° C. The febrile crises follow each other every 24 hours with great regularity and in the intervals the temperature may drop from 1° to 2° C.

Eruptions rarely occur during the first crisis; they are usually observed during the second and not rarely during the third or even the fourth crisis. In the more severe forms, especially after inoculation by scarification, the eruptions appear sooner while on the other hand following inoculation with virulent red corpuscles it is not rare to observe even the initial eruptions during the fourth febrile crisis. In all cases the eruptions do not occur simultaneously, that is, they do not all develop during a single crisis.

In the majority of cases the red corpuscles were found to possess their maximum virulence at the beginning of the second and third crisis, and to become less virulent during the ascent of the febrile curve; the virulence diminishes at the height, and disappears completely or almost completely during the descent of the curve. The serum on the other hand appears to attain its maximum virulence during the height of the crisis and unlike the corpuscles never appears to lose its virulence completely.

Experiments performed in order to determine the virulence of the red corpuscles and of the serum showed that with equal doses the latter is always more powerful. It might appear that the corpuscles owe their virulence to a small quantity of serum remaining cemented to their bodies after centrifugation,—but, (1) if the corpuscles are washed by repeated centrifugation their virulence remains unchanged, (2) it is impossible to produce the disease by the inoculation of less than $\frac{1}{4}$ c.c. of serum, (3) if the corpuscles and the serum are kept separately in an ice chest the virulence of the serum disappears several days before that of the corpuscles; the serum becomes inactive after remaining in these conditions for 24 days while the corpuscles were shown to be virulent even after 32 days.

With regard to minimum doses required to produce the disease by subcutaneous inoculation, repeated tests showed that in the case of the corpuscles obtained from blood extracted at a favourable moment during the development of the fever in cattle affected with the natural

disease the dose, shown to be the optimum, was 10 c.c. When an outbreak has assumed a serious character one can, however, obtain blood containing corpuscles capable of producing the disease in much smaller doses. In the case of an exalted virus obtained by passages through the bodies of susceptible animals it is not difficult to set up the disease by the inoculation of 1 c.c. of corpuscles. The serum when extracted from the blood at a favourable moment during the febrile curve is capable of setting up the disease with a minimum dose of $\frac{1}{4}$ c.c.

Bovines were used exclusively in connection with experiments for the exaltation of the virus. Passage through swine gives rather better results but as the experiments were performed with the object of providing material for the immunisation of cattle the use of heterologous products presented disadvantages. Commencing with the inoculation of 10 c.c., subcutaneously, of corpuscles from a bovine infected by scarification it was found possible to increase the virulence in the course of six passages so that (1) finally, severe foot-and-mouth disease was set up by the inoculation of 1 c.c., (2) by continuing to inject a constant dose of 10 c.c. a more severe form of the disease was set up each time than in the preceding passage until at last the animals died from the apoplectic form, and (3) the incubation period became shortened from an average of 6 days to 70 hours.

The administration by ingestion of large quantities of infective material such as the products from the vesicles in the mouth and blood (40 c.c. corpuscles and 20 c.c. serum) invariably gave negative results.

Intravenous inoculation gave the following results, care being taken to prevent the escape of material subcutaneously:—(1) In the case of the serum small quantities—$\frac{1}{4}$ c.c.—constantly set up foot-and-mouth disease in the same way as subcutaneous inoculation; (2) the inoculation of red corpuscles even in such a high dose as 35 c.c. never set up the visible disease, whereas 10 c.c. of the same corpuscles inoculated subcutaneously into controls set up symptoms similar to those manifested in the animals from which the blood was originally obtained.

*Immunisation tests.*—While occupied in controlling the method of immunisation proposed by TERNI [see this *Bulletin*, Vol. 4, No. 4, pp. 173], the authors made use of the materials at their disposal in an attempt to discover a vaccine against foot-and-mouth disease. Several experiments were performed, chiefly in the direction of preparing a sensitised vaccine according to BESREDKA'S method; material from the buccal lesions was thus collected and subjected to the action of serum from immune bovines. The material obtained became always so badly contaminated that it was impossible to produce an effective vaccine in this way.

The red corpuscles, however, inasmuch as they could be withdrawn aseptically and possessed a slight virulence, which had hitherto escaped the notice of other authors, proved invaluable for experiments on immunisation. Attempts to sensitise the virus contained in them by BESREDKA'S method proved unsuccessful as no satisfactory method could be devised for keeping the corpuscles intact. The method of vaccination thus consisted in setting up an active immunity by the intravenous injection of virulent corpuscles.

The material necessary for vaccination was not difficult to prepare, easily preserved, and easily administered in practice. As shown above large doses of virulent corpuscles can be inoculated intravenously without setting up external manifestations, but the injection determines a general reaction represented by a rise of temperature which is manifested almost immediately after inoculation, lasts about 24 hours, and reaches about 2° C. above normal; this is accompanied by other symptoms such as depression, increase in respiration, inappetence, and slight disturbance in connection with the gastro-intestinal tract. Animals thus inoculated intravenously were subsequently inoculated subcutaneously with virulent corpuscles, simultaneously with a number of controls, which each received 10 c.c. of the corpuscles, of the same breed and condition. Sixteen cattle vaccinated by means of a single intravenous inoculation were exposed at various intervals during six months to natural infection, and, with the exception of one case, none of these animals developed lesions, whereas all the controls became affected.

The authors conclude that washed corpuscles after intravenous inoculation are capable of setting up a slight general reaction without external lesions and that this initial injection, according to their preliminary experiments, is capable of setting up an immunity which lasts at least two months.

[A very full extract is given above on account of the high administrative authority under which the note is published; the results, however, appear to be so widely different from those of other observers that they must necessarily be read with reserve until the authors issue for criticism full details of their experiments.—Ed.]

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## MISCELLANEOUS.

### (a) Contagious Pustular Stomatitis.

de Jong (D. A). **Le rapport entre le stomatite pustuleuse contagieuse du cheval, la variole équine (Horse-Pox de Jenner) et la vaccine (Cow-Pox de Jenner).** [The Relationship between Equine Contagious Pustular Stomatitis, Equine Variola (Jenner s Horse Pox) and Vaccinia (Jenner's Cow Pox).]—*Folia Microbiol gica.* 1916. Nov. 1. Vol. 4. No. 3. pp. 239–266. With 5 plates comprising 14 figs.

This article opens with a very complete and critical review of the equine affections described variously under one or other of the above names from the time when Jenner (1800) attributed the origin of cow-pox to an affection involving the heels of horses and described simply by him under the name of "grease." Although the disease has been recognised to have been of comparatively common occurrence in England and its occurrence on the Continent often attributed to the importation of English horses very little has been written about it in this country since the time of Jenner. In France, on the other hand, the disease has engaged the attention of various observers and, according to Nocard and Leclainche, Bouley (1860) would be the

first to suggest the name "horse-pox" for outbreaks of a pustular nature among equines. Since CHAUVEAU'S work on variola (1886) it has been held in France that the equine variola, which had been considered up to then as a so-called spontaneous disease, could manifest itself under the form of a vesiculo-pustular eruption not only on the limbs but also on several other parts of the skin and even on the mucous membranes.

In Germany, on the other hand, even comparatively modern authors (EGGELING and ELLENBERGER, FRIEDBERGER, and DICKERHOFF), considered equine variola either as a rare disease or even denied its existence; they maintain, however, that there is a commonly occurring affection of horses known as "contagious pustular stomatitis" to which French authors had given, wrongly according to them, the name of "horse-pox." A so-called "contagious acne" of horses is likewise recognised.

In Holland outbreaks of cow-pox have been definitely known to occur at intervals for over a century, and, according to the author, the disease known as "contagious pustular stomatitis" of the horse is well known to Dutch veterinary surgeons although no accurate figures can be given.

Soon after the mobilisation of the Dutch army at the commencement of the present European war outbreaks of pustular stomatitis occurred in various garrisons stationed near The Hague. Diagnosis was quite easy. Besides stomatitis there were often seen pustules on the skin of the head and other parts of the body as well as at the extremities of the limbs.

The following are briefly the symptoms manifested in one outbreak affecting 300 requisitioned horses. The first symptom consisted in marked salivation, especially during feeding, but the appetite was not diminished although the horses ate with difficulty. A multitude of small papules are found at this stage on the mucous membrane of the lips, especially the upper lip, occupying the site of the follicles; there is a small amount of fever, then small vesicles filled with a clear liquid appear, especially on the upper lip, occupying the sites of gland follicles. The submaxillary lymphatic glands may then become congested.

The second stage is seen in one or two days. The contents of the vesicles become turbid giving rise to pustules. The epithelium is then shed leaving small cavities from the size of a large pin's head to that of a small pea. These small ulcers often become confluent and give rise to irregularly-shaped excavations. These changes are seen on the insides of the lips, on the gums above the incisor teeth, and on the tongue. The lesions cause very excessive salivation and often a foetid odour from the mouth and swelling of the lips. The excoriations then heal and in about 10 days every trace of eruption has disappeared from the lips. The tongue lesions heal rather more slowly.

In some animals besides eruptions there are seen swellings on the skin. Two horses showed a large number of papules on the neck, shoulders, chest and fore legs. One of these animals presented during this second stage a cutaneous eruption in the form of local thickenings on the chest and fore legs; these burst, became confluent and formed a sort of granulating surface. Four horses showed a continuous inflammation in the hollow of the heels of the fore and hind limbs. The swellings

were first observed, then the hairs became moist and finally the heel became scabby. Under the scabs were found small rounded granulating ulcers similar to those found on the lip but not confluent. No lesions were found on the mucous membranes other than those of the mouth.

The period of incubation may last from four to six days, the virulence is greatest at the commencement of an outbreak, and it was at this period that the largest number of cutaneous eruptions were observed. Later on, these eruptions became rarer, and also the excoriations on the tongue. Even the eruptions on the skin and mucous membrane of the lips became less serious and one might observe sometimes healing by absorption without rupture of the pustules. Transmission of the disease by means of the saliva appears to be most frequent.

The diagnosis is easy although at the beginning one may be dealing with normal or diseased follicles. However, the glandular congestion and the contagious nature of the disease prevent error.

Treatment shows no difficulty as the affected animals recover spontaneously.

*Experimental.*— In this connection the author performed numerous experiments on the transmission of contagious pustular stomatitis of horses to healthy horses and also to calves, rabbits, and children, both with fresh exudate and exudate after filtration through a porcelain filter. Some transmission experiments with cow-pox lymph were also made. The following are the author's own conclusions :—

"(1) In the cases observed of contagious pustular stomatitis of the horse an eruption was found in the mouth and on the skin.

"(2) The material collected from the mouth of affected animals was capable of transmitting experimentally the disease including the cutaneous eruptions.

"(3) The same material passed through Chamberland B. and F. filters retained the same infectivity.

"(4) Vaccinia cultivated in the ordinary manner was equally capable of producing in the horse the pustular stomatitis including the cutaneous eruptions.

"*The horse which had contracted spontaneously the stomatitis was refractory to inoculation with vaccinia.*

"(5) Two different strains of virus of contagious pustular stomatitis of the horse behaved like vaccinia in the course of inoculations into the calf and the rabbit ; in the latter animal also the corpuscles of Guarnieri were obtained in the inoculated cornea. Besides, the deviation of the complement test furnished still further corroborative proof of this contention.

"(6) The vaccine obtained by inoculation of virus of contagious pustular stomatitis of the horse could be cultivated regularly on animals as easily as the ordinary vaccine. This vaccine of equine origin gave excellent vaccinal pustules in the case of children inoculated with it.

"*The re-vaccinated children showed only a re-vaccination reaction.*

"(7) Rabbits inoculated with ordinary vaccinia and which had shown a strongly positive reaction, after recovery and re-vaccination with the stomatitis virus, manifested only an early allergic reaction (von Pirquet); on the other hand controls showed a characteristic eruption.

"(8) We have proved that the contagious pustular stomatitis of the horse is actually the most common form of Jenner's horse-pox and that the virus of this stomatitis passes through Chamberland B. and F. candles. This fact was hitherto unknown."

GREGG (James). **Vesicular Stomatitis Contagiosa.**—*Vet. Record.* 1917. Mar. 17. Vol. 29. No. 1497. pp. 381–382.

This preliminary note deals with the occurrence and etiology of a disease affecting horses and mules at the British Remount Depot, Newport News, Virginia, U.S.A.

The clinical nature of the disease is passed over briefly. It is merely stated that the mouth lesions resembled those of foot-and-mouth disease, but that there were no lesions about the feet. 85 per cent. of horses, 75 per cent. of large mules, and 25 per cent. of small mules became affected in the scene of an outbreak. "The period of incubation averages three days, starting with an inflamed mouth, then in a short time the formation of vesicles on the sides and point of the tongue, and sometimes on the lips—these break almost immediately, leaving red inflamed surfaces. Constitutional disturbance is slight. Period of attack averages one week. Animals usually eat a little, but fall off considerably in condition."

The bacteriologist (GREGORY G.) of the Depot isolated from the pustules a staphylococcus growing slowly and meagrely on ordinary laboratory media and producing no harmful effects after intraperitoneal inoculation into the rabbit or guinea-pig.

Some transmission experiments were attempted with sub-cultures of this organism. An emulsion rubbed on the tongue and lips of four mules gave negative results after four days, but inflammation of the mouth and mild salivation was observed in three of them on the sixth day. Intravenous inoculation of the organism produced in one mule after 48 hours cording of the veins and lymphatics under the tongue and inflammation of the buccal mucous membrane, copious salivation, and a rise of temperature of 1° F. Inoculation of large doses under the mucous membrane of the tongue produced, in two mules, at the seats of injection after 24 hours, pronounced nodules, and then vesicles in from 48 to 72 hours. The coccus was recovered from these vesicles.

[The author apparently feels justified in heading this brief record of transmission experiments with the words, "A mild form of the disease produced." His experiments are, however, most inconclusive and hastily published. The clinical history of the natural disease is but briefly discussed, but it may be inferred that *multiple* vesicles were found on the lips and buccal mucous membrane and that the disease was extremely contagious. Neither of these conditions were fulfilled in the experiments with the organism described. The author would be well advised to consult the article published recently by DE JONG on what is most probably an identical disease (see above extract).—ED.]

GREGG (James), MCGUIRE (F. X.), GLOVER (G. J.), GILLESPIE (A.) & GREGORY (G.). **Vesicular Stomatitis Contagiosa.**—*Amer. Jl. Vet. Med.* 1917. April. Vol. 12. No. 4. pp. 221–222.

This article is almost entirely identical with that published by Gregg alone (see above) with the exception that another series of experiments in connection with the organisms isolated from the lesions are described.

"The organisms isolated from the inoculated animals were injected into the tongues of two mules, with negative results.

"The original cultures were used on two horses and three mules as follows :—

"(1) A seven-year-old bay gelding had four cc.'s of a heavy suspension injected per jugular with negative result.

"(2) A nine-year-old black gelding had four cc.'s injected under the tongue ; result was mild inflammation of the mouth on the third day, which disappeared rapidly.

"(3) A black mule gelding had four cc.'s intravenously with negative result.

"(4) A black mule had four cc.'s injected into the tongue, results were mild inflammation of the mouth on the third and fourth day.

"(5) A grey mule gelding had four cc.'s injected into the tongue. Animal showed active inflammation of the mouth with salivation on the fourth and fifth day."

The authors then add a note stating that at the time of writing the disease had disappeared entirely from their pens and hospitals—"in fact, it went out as suddenly as it came in." The disease is stated to have lasted four months and produced several thousand cases. The symptoms are described a little more fully and they correspond with the descriptions given elsewhere. In this paper the reader is asked to draw his own conclusions from the results of the experiments.

MORI (Nello). **Sul germe specifico della Stomatite pustolosa contagiosa degli equini e Afta di Regis.** [The Causal Organism of Contagious Pustular Stomatitis in Equines or King's Aphtha.]—*Clinica Vet.* 1917. July 15. Vol. 40. No. 13. pp. 381–383.

In 1909 the author studied the above disease in a number of Hungarian remounts imported into Italy. He came to the conclusion that the disease was a pathological entity and not a form of horse-pox as the majority of French, English, and Italian authors maintain. Pure cultures of an organism which he maintains to be similar to that described recently by GREGG (see above) were isolated from the vesicles.

EICHHORN (Adolph). **Vesicular Stomatitis in Cattle.**—*Amer. Jl. Vet. Med.* 1917. Mar. Vol. 12. No. 3. pp. 162 & 170.

The United States Bureau of Animal Industry received rather alarming reports from Kansas and neighbouring parts that a disease existed among the livestock, particularly among cattle and horses, closely resembling foot-and-mouth disease. On arrival at the scene of the outbreak Eichhorn observed that the buccal lesions resembled those of foot-and-mouth disease so closely that a differentiation was almost impossible. In early cases typical vesicular formations with an accumulation of lymph were found. These vesicles ruptured readily, leaving a surface similar to that seen in foot-and-mouth disease. The lesions were not confined to any part of the mouth, the tongue was affected in about 50 per cent. of the cases, the dental pad was rather more frequently affected ; the other parts of the buccal mucous membrane showed lesions varying in frequency. The regenerative process progressed very rapidly, the only difference from foot-and-mouth disease being that in some cases the eroded parts were covered with a thick gelatinous pseudo-membrane.

Inoculation tests.—Three calves were inoculated by scarification and five others, kept in another isolated pen, were inoculated intravenously

with material from the lesions. The scarified calves developed lesions on the dental pad in 48 hours but these were not quite typical in appearance. The calves inoculated intravenously remained unaffected. Interdigital inoculation of five pigs gave negative results. Likewise horses inoculated by rubbing infected material on the tongue showed no lesions on the third day and so the tongue was re-inoculated by scarification. "One of the horses on the third day developed a vesicle on the dorsum of the tongue and, as in the successful transmission to horses in Washington, on the following day an expansion of the disease was observed affecting almost the entire surface of the tongue."

The disease differed from foot-and-mouth disease in the following respects:—(1) the transmissibility of the disease to horses from cattle and the failure to infect pigs, (2) the absence of foot lesions in infected and exposed cattle, (3) the appearance of newly-formed vesicles after the commencement of the healing process in some cases, (4) the immunity of a large proportion (up to 60 per cent.) of exposed animals in some centres, and (5) the temperature was not observed to rise over 103° F.

JOHNSON (P. E.). **"Infectious Stomatitis."**—*Jl. Amer. Vet. Med. Assoc.* 1917. Mar. Vol. 50. (New Ser. Vol. 3.) No. 7. pp. 882–883.

In this short article the author describes a recent outbreak of stomatitis affecting about 1,000 head of horses and cattle in South Dakota, U.S.A.

In other parts of the United States it has been recognised that this disease may take on either a very mild or a severe course. The disease was introduced into South Dakota by means of five horses which had been exposed to infection in Sioux City. One of these horses showed symptoms on the day after arrival and on the following day similar symptoms were noticed in several other horses. These animals were placed under quarantine as an inspector had noticed the disease in several of the cows and among some of the horses in the yard. "On the same day, immediately preceding the quarantine, and also on the two previous days, there were thirty-five different ranchmen from various parts of the country, that had stabled and fed their teams and saddle horses in the barn and were thus exposed but had removed their horses before the quarantine was placed on the barn. From ninety to ninety-five per cent. of the exposed animals developed the disease. Among the first animals exposed it spread more rapidly than it did later and the disease was more severe in the animals first affected in a herd than in those it developed in later."

"The disease develops in from three to five days after exposure, and it is recognised by the animals refusing to eat and showing a good deal of slobbering. They generally have a rise of temperature of from two to three degrees, and also show some lassitude. The lesions are found mostly on the lips and on the dental pad of the cattle, and on the tongue and sides of the mouth in the horse. In some of the horses the whole upper surface of the tongue was entirely raw, and there was an odor of necrosis, especially in the neglected cases."

The most common method of infection is through eating hay soiled with the saliva of infected animals. The period over which an animal will spread the infection is probably not over one week. The disease causes practically no mortality among stock but the animals are left in a run-down condition from the attack. Treatment consisted in quarantining the exposed stock, separating the infected from the non-infected, and washing the mouths of infected animals with a solution of potassium permanganate once daily. In very severe cases the lesions were curetted and tincture of iodine applied once.

PANISSET (L.). **À propos de la stomatite vésiculeuse du cheval (stomatite ulcéreuse, stomatite érosive).** [Vesicular, Ulcerative, or Erosive Stomatitis in the Horse.]—*Rev. Gén. Méd. Vét.* 1917. May 15. Vol. 26. No. 305. pp. 181–183.

"The vesicular stomatitis observed among horses at the front by some observers and summarily described since 1915 as a new disease has, in the course of the last few months, spread considerably, but not alarmingly as the disease has so far shown no malignant tendencies. The veterinary hospitals especially and numerous units which have received horses from centres primarily affected have suffered considerably from the disease."

The author proceeds to show that this disease was most probably imported into France from America by means of infected remounts. The U.S.A. Bureau of Animal Industry during the latter months of 1916 investigated the disease affecting a very high proportion of remount concentration depots at Chicago, Nebraska, and Colorado. The disease was also seen in America to spread to the ox, but the pig and sheep remained refractory, hence the non-identity of the affection with foot-and-mouth disease. The Bureau, moreover, observed that the disease transmitted by inoculation possessed a longer period of incubation at each new passage. Transmission experiments with filtered products failed.

BURTON (A. C.). **"Stomatitis Contagiosa" in Horses.**—*Vet. Jl.* 1917. July. Vol. 73. No. 7. pp. 234–242. With 4 figs.

This author furnishes a good clinical record of the above disease as it occurs among British army horses in France. The number of outbreaks and cases dealt with is unfortunately omitted.

The disease is defined as "a contagious disease characterised by vesicular eruptions in the mouth with subsequent more serious and characteristic lesions therein; similar lesions on m.m. of oesophagus and stomach, with an acute gastro-enteritis; occasionally, also, an eczematous coronitis." It is stated that the condition is different from the disease described by FRIEDBERGER and FROHNER as "stomatitis contagiosa pustulosa." Horses readily contract the disease; mules are not so susceptible, but are by no means immune. It is transmissible to man; the author himself and two of his assistants contracted it. The disease was of short duration, of a mild character although very painful, and confined to the mouth, the lesions being similar to those described in the case of the horse. The disease is readily amenable to treatment with the aid of mild antiseptics.

The period of incubation is said to be short, 24 hours to three days. The immunity conveyed by one attack appears to be of short duration; re-infection took place in less than two months. All classes and ages of horses are affected to the same degree.

The initial symptom is an inflamed condition of the mucous membrane of the mouth or lips speedily followed by the formation of vesicles. On the lips the vesicles are most common at the junction of the skin and mucous membrane, and are usually discrete and rupture quickly. "A crusty eczematous appearance" is then produced. A few vesicles may appear on the skin itself. Similar vesicles are found within the lips and on the gums and have a tendency to coalesce before bursting. Vesicles are also quite common on the upper and lower palate, especially on the bars, and on the mucous membrane of the cheeks, but they are usually not so severe in these places. The most serious buccal lesion is found on the tongue where the vesicles coalesce over a large area, forming subsequently large eroded patches. Salivation varies in amount, and may not be present at all. It may be said to take place only where tongue lesions exist. In severe cases the odour from the mouth is very offensive, resembling that from the breath of an animal suffering from gangrenous pneumonia. Colic is a frequent symptom, more especially in cases running an unfavourable course. The pulse assumes a rapidly falling character; the visible mucous membranes are highly congested. Fever is present only in very severe cases and in cases complicated with abdominal lesions; the temperature may then reach 103° to 104° F. The appetite remains good where the mouth lesions are not severe but severe lesions prevent feeding and an animal thus affected wastes rapidly. Healing takes place in from a fortnight to two or three months but complications affecting the digestive tract may set in when recovery is apparently complete.

The foot lesions are described as "an eczematous coronitis." The affection is seen in one or more feet, is very painful, and develops rapidly. Acute lameness may set in suddenly, vesicles appear almost immediately, rupture, and a straw-coloured exudate trickles down the wall of the hoof. The heel is the part most often primarily affected and thence the lesions often spread rapidly all round the coronet. The coagulated serum forms a thick crust over the part. These lesions are generally observed at the same time as the mouth lesions.

According to the author the disease often runs "an unfavourable and even fatal course."

On post-mortem examination one finds mouth lesions of varying severity, marked emaciation, although the stomach and intestines may be comparatively full of foodstuffs where the mouth lesions permit of normal feeding. Lesions as on the tongue and lips may be found on the mucous membrane of the oesophagus, also quite commonly in the stomach, especially at the junction of the villous and cuticular membranes, and they are found to vary in age and severity. In such cases an acute gastro-enteritis is invariably found. No characteristic lesion is, however, found in the intestine.

Local treatment by means of antiseptics such as potassium permanganate, potassium chlorate, and copper sulphate appear to have a very beneficial effect. The mode of treatment employed by the author consists in placing all the more seriously affected animals side

by side in a stable. Three or four times a day the horses' mouths are washed out with a solution of potassium permanganate (½ oz. to 5 gallons cold water). This solution is carried on the back of a dresser who inserts the nozzle of the sprayer, covered with a piece of rubber hosepipe perforated with a series of small holes, carefully into the mouth of each horse as he passes along in front of the horses. The treatment is apparently not resented by the horses.

GIBBS (H. E.) & POOK (G. G.). **A Report upon an Outbreak of Stomatitis Contagiosa.**—*Vet. Jl.* 1917. May. Vol. 73. No. 5. pp. 147–155. With 4 text figs.

This paper contains some notes on the clinical appearance of the above disease together with brief accounts of two series of experiments. The disease is stated to differ from the "true Pustular Contagiosa, in so far as it is possibly more readily transmissible, certainly extremely benign, and has apparently no deleterious effects on animals suffering from it." [The authors' evidence for this statement is not given. It is not known whether a differentiation from the so-called "true Pustular Contagiosa" is made on account of their personal experience with that disease or from the descriptions given in the literature in connection with it. The article is neither well written nor well edited.]

The temperature was found in some cases to rise to 103° F. 24 hours before the vesicular eruption appeared and remains high for 48 hours. There is a profuse discharge of mucous saliva at the commencement of the disease; this often becomes frothy later on. In the course of the outbreak animals were noticed with intense salivation and showing only congestion of the buccal mucous membrane, disappearing spontaneously a few days afterwards.

The lesions are found confined to the buccal mucous membrane, most commonly the tongue. They vary considerably in size, a single vesicle often measuring 1 inch in diameter; a number of vesicles often coalesce to form one large bleb; this bleb quickly ruptures, discharging a straw-coloured serous fluid, and leaves a raw congested surface to which a few hours afterwards a straw-coloured jelly-like substance is found adherent.

The disease was found to take from four to six weeks to run its course. Healing took place from both the periphery and the bottom of the lesions, in most cases leaving no trace of the disease. Large lip lesions often left behind them elongated scars.

The smaller lesions did not appear to affect the animals' ability to feed, but the larger ones caused difficulty in feeding and consequent loss of condition. The infection was most probably carried by the indirect method. Treatment consisted in feeding on soft food and the administration of antiseptics locally.

Experimental.—The period of incubation after inoculation of the the contents of the vesicles was found not to exceed 24 hours in the case of two horses, one of which was inoculated with the fluid underneath the mucous membrane of the tongue, while in the case of other horse the fluid was applied to the scarified tongue surface. No lesion followed the inoculation of fluid beneath the skin of the coronet.

When the mode of transmission was made to simulate the probable natural method of infection the results were very irregular. Ten

horses and five mules were thus isolated and the saliva from the mouths of badly affected animals applied in various ways to their buccal mucous membranes, viz., by application of cotton-wool soaked in discharges, drinking from contaminated vessels, and ingestion of contaminated food, etc. Two of these horses were kept as controls. Typical lesions developed in seven of these horses in from 5 to 19 days. Two of these horses, however, were the controls, which became affected in 10 and 14 days, respectively. The lesions produced in the more retarded cases might thus not have been due to the original application of discharges. Three of the horses and all the mules did not become visibly affected.

In another similar series of experiments in which the same number of animals were used, one horse and three mules being kept as control animals, eight of the horses including the control became affected on the day following the experiment, and the ninth on the second day. The tenth horse developed no lesions. Three of the mules, including two controls, developed lesions on the first day, another control on the second day, and the remaining mule on the fifth day after the commencement of the experiment.

According to the authors' opinion, it is the vesicular contents which should be held responsible for the disease and the lesions lose their infectivity shortly after the rupture of the vesicles. In support of this statement they quote an experiment in which five susceptible horses were rubbed on the scarified surfaces of their tongues with a piece of cotton wool soaked on a serious lesion of four days' standing. No lesions were subsequently found in any of these horses on examination extending over a period of 14 days.

### (b) Contagious Agalaxy of Goats.

Sergent (Edm.) & Roig (G.). **Sur l'existence de l'agalaxie contagieuse des chèvres en Algérie, et sur une infection surajoutée.** [Contagious Agalaxy of Goats in Algeria and a Secondary Infection.]—*Bull. Soc. Path. Exot.* 1917. July. Vol. 10. No. 7. pp. 575–585. With 1 text fig. & 1 chart.

Conclusions:

"Contagious agalaxy of goats occurs in Algeria. We witnessed in 1908 an outbreak remarkable on account of its suddenness and its violence. In three months it killed off 124 out of 450 goats (27·5 per cent.), attacking especially the young animals.

"In the natural disease mammary lesions are constant, articular lesions frequent, while ocular lesions were not observed. Thus animals not producing milk only showed articular symptoms.

"In the experimental disease the mammary and articular lesions are constant. Ocular lesions were observed in 2 cases out of 13.

"Inoculation of blood of infected animals did not transmit the disease and produced no subsequent immunity.

"Inoculation of milk subcutaneously or intraperitoneally produces the disease with certainty in goats. Intraperitoneal inoculation does not infect the guinea-pig or the rat.

"The virus did not become attenuated by passages.

"Ingestion of infected milk did not produce the disease.

"One goat contracted the disease by cohabitation.

"In the outbreak studied a polymorphic organism belonging to the Preisz-Nocard group was constantly found in the milk, but not in the blood.

"The inoculation of cultures of this organism was not pathogenic.

"This organism is undoubtedly a concomitant parasite ("*temoin*") of the ultra-visible virus discovered by CELLI and Dante de BLASI. It does not even seem to play the part filled by CARRÉ'S pyobacillus in 'mal de Lure.'

"It appears to be merely a secondary invader following the infection set up by the specific virus."

### (c) ERADICATION OF LOCUSTS.

VELU (H.). **Deuxième campagne d'expérimentation de la méthode d'Hérelle au Maroc contre *Schistocerca peregrina* Olivier (mars-juillet 1916).** [Second Experimental Campaign for the Destruction of Locusts in Morocco by means of D'Hérelle's Method. March-July 1916.]—*Ann. Inst. Pasteur.* 1917. June. Vol. 31. No. 6. pp. 277–290.*

Conclusions:

"From facts observed during the 1915 campaign the following conclusions were drawn:—*There may exist among invading swarms of locusts outbreaks of contagious enteritis set up by a coccobacillus of the same group as D'Hérelle's bacillus.* The severity of these outbreaks is variable. *They prevent the exaltation of the virulence of D'Hérelle's coccobacillus maintained* in vitro.

"*The locusts which are born during the passage of contaminated swarms are infected by means of the dead bodies.*

"The coccobacillary enteritis of locusts is perhaps a more common disease in nature than is at present believed. The mortality observed in 1910 by Dr. D'Hérelle in America is probably common in Africa. This possibly accounts for the disappearance of swarms for several years, and for the long periodicity of the invasions.

"Schistocerca peregrina *Olivier is distinctly susceptible to infection by means of D'Hérelle's coccobacillus at all stages in its development,* but as contamination is brought about almost entirely by means of cannibalism the outbreaks set up are proportional in severity to the ease with which the diseased insects are devoured by their neighbours.

"The factors which tend to render the infestations more efficacious include all those which increase the density of the swarms of locusts and consequently favour cannib lism.

"*The most favourable time for spraying is at the end of the third stage.* The locusts are not then formed up in columns; they form dense compact masses which move about very little. They are so close together that contamination of the pastures is certain and that the affected insects are devoured without fail as soon as they are too weak to protect themselves.

"*From the commencement of the fourth stage and onwards the propagation of the infection is much less certain.* Sprayings no longer have the same efficacity; the density of the columns is less, the distance covered each day becomes gradually greater; the dead bodies are spread out over a large area; *the affected insects form behind the main column échelons of stragglers which die separated from the others and are thus useless for further propagation of the infection.* As one nears the time of the last moult, the columns of locusts become submitted to more and more strict sanitary rules which bring about the automatic elimination of disease carriers. The last stages of larval life are thus not favourable for the application of the biological method, *especially in open country.*

"The application fo D'Herelle's method demands a precision so difficult to obtain that one cannot with our present knowledge consider it as sufficient in itself to bring about wholly the solution of the important problem of eradicating locusts. But on the other hand one cannot dispute that its efficacity when applicable renders it distinctly superior to all other

* The subject matter of this paper has previously been dealt with briefly by the author in another paper [see this *Bulletin*, Vol. 5. No. 1. p. 56].

methods, and especially more economical. Without thinking of abandoning any of the other means of protection hitherto employed the greatest and most certain advantages should be taken of the biological method.

"As a very large number of larvae are never hatched at the same time but are hatched successively in the same region at times varying with the aspect and nature of the soil, a single body of men cannot carry out all the infection operations, especially if one admits that these infections must be made on the clusters of larvae before the formation of columns. It is thus indispensable to find out and infect all the masses of locusts before the tenth day. For this purpose one must thus provide an organisation for a district composed in the following manner: One veterinary surgeon belonging to the Department of Animal Industry, three mounted European "infectors" and three camelmen.

"The stocks of broth should be made up in each centre immediately on the arrival of the swarms and the virulent material should be prepared beforehand in the research laboratory of Casablanca.

"Finally, as it has been observed that the swarms just when entering the country showed a considerable mortality and infected the clusters of young locusts, it is best to infect the swarms directly on their arrival in the south, at Agadir, and even further if possible.

"Applied on a large scale the biological method must considerably diminish the damage done by the swarms of locusts as well as that done by the clusters of young locusts, and consequently facilitate in a large measure the mechanical means of combat and reduce the considerable expenditure which this involves." . . .

### (d) Camel Purgatives.

Cross (H. E.). **A Note on the Action of Purgatives on the Camel.**—6 pp. 1917. Lahore: Supt. Govt. Printing Punjab.

As the result of experiments in the administration of various quantities of the commonly used purgatives to the camel the author's experience led him to summarise his views as follows:—

"To produce purgation in the camel the following doses require to be given:—8 oz. kamala; 4 pints linseed oil; 3½ drachms of croton oil; 3½ ozs. aloes solution; 1½ to 2 lb. magnesium sulphate; 3 ozs. gamboge; 2 grains eserine and 2 grains pilocarpine given subcutaneously.

"Of the purgatives tried the best purgative for the camel is magnesium sulphate; the others come in the order named:—kamala, croton oil, aloes, gamboge, linseed oil. Eserine and pilocarpine gives very satisfactory results, in doses of 2 grains eserine and 2 grains pilocarpine subcutaneously."

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## REPORTS.

British Guiana. **Report on the Veterinary Division** (Milne, A. Seton, Government Veterinary Officer). Reports of the Department of Science and Agriculture, for the Nine Months ended 31st December, 1915. Appendix iv. 5 pp. f'cap. 1916. Georgetown, Demerara: Govt. Printers.

The only serious outbreak of infectious disease dealt with in this report was one of anthrax, which was soon brought under control by the inoculation of nearly all the animals (12,000) in the infected area with anthrax vaccine.

Two outbreaks of contagious pneumonia occurred among mules.

There were no outbreaks of swine fever or glanders.

Mal de caderas did not reappear during the year.

An imported shorthorn bull kept for breeding purposes showed continuous daily high fever; its blood was found to contain trypanosomes, which were not identified. Intravenous injection of a Brazilian preparation called "sodium protosonate" every third day soon brought about a recovery and the disappearance of the trypanosomes from the blood.

A few details are added with regard to some small breeding experiments with imported pigs and a stallion.

CEYLON. **Administration Reports, 1916.** Report of Government Veterinary Surgeon [STURGESS, G. W.]. 6 pp. f'cap.

A mild outbreak of influenza was the only infectious disease noted among horses.

856 cases of rinderpest were reported amongst cattle as against 1,493 last year; the mortality was about 77 per cent. 223 cattle were inoculated with anti-rinderpest serum and of these 138 remained free of disease; of the remaining 85 affected cattle, 38 recovered and 47 died.

There was a marked decrease in the prevalence of foot-and-mouth disease—284 cases as against 2,366 in 1915.

Four cases of surra were detected; two animals died naturally and two were destroyed.

Anthrax was found to be very prevalent amongst goats and sheep imported from India. Out of 76,820 of these animals imported into the quarantine station at Colombo 1,196 died from anthrax (1½ per cent.). Twenty deaths from this disease occurred in the island.

An outbreak of infectious ophthalmia occurred amongst cattle involving 64 cases. All recovered under treatment.

The outbreak of so-called swine septicaemia recorded in the preceding year ended in July, 1916. There were 274 cases as against 2,512 in 1915. "A possible carrier of this disease is *Ctenocephalus canis*, which was found infesting sick pigs."

Out of 23 cases of suspected rabies four were found positive.

The following insects were identified:—*Tabanus striatus* Fb., Kandy District, in April; *Pycnosoma flaviceps* Mag., the cause of myiasis in a dog's mouth, Colombo, November; and the tick *Boophilus australis* Fuller, Experiment Station, Peradeniya.

Losses due to parasitic gastritis caused by *Haemonchus contortus* are recorded.

Statistics are included with regard to disease returns, importation of animals, stock farm, and expenditure.

SOUTHERN RHODESIA. **Abridged Report of the Chief Veterinary Surgeon** (SINCLAIR, J. M.). Abridged Report of the Director of Agriculture for the Year 1916. pp. 5–7.

The greater part of this report deals with the outbreaks of East Coast fever in cattle recorded during the year. The year was marked by the appearance of this disease in the Mrewa District, in which it had not at any time previously existed and its re-appearance in the

Gwelo District after over ten years freedom from it. The source of the infection could not be traced in either case. Notwithstanding these outbreaks in previously clean districts the position shows a marked improvement as compared with the previous year. There were fewer fresh outbreaks—20 as against 35—and a greatly decreased mortality—382 as against 1,174. Of the 38 centres in which the disease occurred during 1915 only 15 showed infection during 1916. Details are added with regard to the method of dealing with these outbreaks in the various districts.

Shortly after the heavy rains fell in the Bulalima-Mangwe District in November several outbreaks of blackquarter occurred and the mortality was somewhat heavy. It was reported that animals of all ages contracted the disease and that a number recovered. Only two outbreaks of this disease had previously been recorded since the occupation of the country.

Tuberculosis was detected in one herd. Amongst the 12,719 head of slaughtered cattle exported to the Johannesburg abattoirs five cases of tuberculosis were discovered.

A few fresh centres of contagious abortion were discovered. Treatment by the injection of large doses of dead bacilli is still adopted and the results were apparently favourable.

No cases of anthrax, contagious pleuro-pneumonia of cattle, rabies, or glanders occurred.

The mortality from horse sickness was one of the slightest on record.

An outbreak of equine influenza occurred affecting about 90 per cent. of horses and many mules and donkeys. A slight mortality occurred among donkeys and mules but none in horses.

## RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 5, No. 2, pp. 134–140.]

### PROTOZOAN PARASITES.

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——. On the Sporozoon Parasites of the Fishes of Wood's Hole and Vicinity. II. Additional Observations upon *Myxobolus musculi* of Fundulus and a Nearly Related Species, *M. pleuronectidae* of *Pseudopleuronectus americanus*.—*Jl. Parasit.*, 1917. June. Vol. 3. No. 4. pp. 150–160. With 1 plate comprising 18 figs.

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[This article has already been extracted from another paper, see this *Bulletin*, Vol. 4. No. 4 pp. 159–160.]

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